METAL INDUSTRY

WITH WHICH ARE INCORPORATED

ALUMINUM WORLD — COPPER AND BRASS

BRASS FOUNDER and FINISHER

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Institute of Metals Division Meeting

Winter Meeting Held in New York. Papers on Theoretical Metallurgy, Practical Metallurgy Aluminum, Platinum and Gases in Metals

THE Institute of Metals Division of the A. I. M. E. held its annual winter meeting from February 20 to 23rd, at the Engineering Societies Building, 29 West 39th Street, New York, in conjunction with similar meetings of the main body, the American Institute of Mining and Metallurgical Engineers.

As usual the meetings were well attended and a wide variety of subjects was included in the program.

Special features consisted of the Annual Institute of Metals Lecture, this year delivered by Dr. Georg Massing of Germany, and a non-technical talk, also an annual feature, this year delivered by E. M. Wise of the International Nickel Company, on Platinum.

Dr. Frederick M. Beckett, vice-president of the Union Carbon and Carbide Corporation, New York, was elected president of the A. I. M. E.

New officers of the Institute of Metals Division were as follows:

Truman S. Fuller, Metallurgist, Research Laboratory, General Electric Company, Schenectady, N. Y., **Chairman.**

John L. Christie, Metallurgist, Bridgeport Brass Company, Bridgeport, Conn., **Vice-Chairman.**

W. A. Scheuch, Works Manager, Nassau Smelting & Refining Company, Inc., Tottenville, S. I., N. Y., **Vice-Chairman.**

T. S. FULLER
Chairman

W. A. SCHEUCH
Vice-Chairman

E. M. Wise, Assistant Director, Research Laboratory, International Nickel Company, Bayonne, N. J., **Secretary.**

Jerome Strauss, Chief Research Engineer, Vanadium Corporation of America, Bridgeville, Pa., **Executive Committee.**

Robert F. Mehl, Research Laboratories, American Rolling Mill Company, Middletown, O., **Executive Committee.**

Donald K. Crampton, Metallurgist, Chase Companies, Waterbury, Conn., **Executive Committee.**

H. A. Bedworth, Metallurgist, American Brass Company, Waterbury, Conn., **Executive Committee.**

The retiring Chairman, **Dr. Mathewson,** tendered the thanks of the Division to the outgoing secretary, **W. M. Corse,** who had served the Division as secretary-treasurer for many years. Mr. Corse will continue to act as treasurer.

Abstracts of Papers on Non-Ferrous Metals

PLATINUM IN ART AND INDUSTRY

Annual Non-Technical Talk at the Institute of Metals Dinner

By E. M. Wise

Total world production of platinum up to the present time has been less than 12,000,000 ounces, which is equivalent to about half a year's production of gold. Total world production of gold to date has been more than one billion ounces. Production in recent years indicate that platinum is 100 times rarer than gold and 1,000 times rarer than silver, although sufficient deposits are available to assure the world of an adequate supply for future generations.

Platinum is better adapted than gold for many of the artistic and industrial purposes which annually require 6,000,000 ounces of the yellow metal. Every ounce of platinum or palladium—two of the six metals of the platinum family—used for these purposes would release an ounce of gold for monetary use. The other four metals of the platinum group are iridium, rhodium, ruthenium and osmium.

A trend toward "tailor-made" alloys of the platinum metals to fit definite industrial needs has begun. Important new applications of platinum for equipment operating at very high temperatures or under extremely corrosive conditions are developing.

In normal times about $80,000,000 worth of platinum jewelry are annually sold in the United States. Platinum created the universal demand for white jewelry, and raised the artistic standard of craftsmanship. In recent years, there has been an overemphasis of the cost factor, with the result that there exists at present an opportunity for platinum again to bring up the standard of the jeweler's art in providing craftsmen with a metal worthy of their skill.

The farmer who may never own a bit of platinum jewelry owes a great debt to this precious metal because platinum, used as a catalyst, has made possible the production of nitric acid, and hence of synthetic nitrates for fertilizer. This has made the world independent of Chile as a source of nitrates and has permanently dissolved the fear, current only a few years ago, of a world shortage of nitrates.

Because of the high melting point of platinum metals and their freedom from oxidation, it is now possible to construct electric furnaces which will operate at temperatures as high as 3,600 degrees F.

Platinum alloys are making possible the "white mouth." Lighter, stronger and whiter dental alloys, inconspicuous in the mouth, can now be produced from alloys of the platinum family than from other metals at no greater cost.

Actual tests in the aircraft type of high-tension magneto have shown that the weight loss of the iridium-platinum contacts in a 100-hour run at a speed of 2,500 R. P. M., amounts to less than 1/1,000 gram of the alloy, worth about one-fifth of a cent. If this magneto were applied to a modern eight-cylinder automobile, this performance would correspond to a whole year of driving.

Platinum can now be fired on to porcelain and terra cotta, and its use for decorating dinner sets and for building ornamentation is consequently expected to increase in the near future.

Palladium forms stable alloys with hydrogen which are quite hard though not unduly brittle. At the same time, palladium is actually transparent to hydrogen, great

E. M. WISE
Secretary

D. K. CRAMPTON
Executive Committee

JEROME STRAUSS
Executive Committee

quantities of the gas being able to pass right through a thin solid sheet of palladium. This property makes the metal useful for filtering hydrogen from other gases. Palladium is also being used to replace white gold, and its cost is approximately equal to that of 18K white gold.

PRESENT-DAY PROBLEMS IN THEORETICAL METALLURGY

Annual Lecture of the Institute of Metals

By Dr. Georg Massing

Physical metallurgy deals with all the methods of treating metals, once they have been obtained in the metallic state, and with all the properties of metallic systems. It covers the whole science of metals from the standpoint of their internal structure. This structure refers to the atomic arrangement as well as the macrostructures of a metal.

Dr. Massing dealt only with the theoretical views of physical metallurgy and not with its practical applications. He discussed some of the problems of physical metallurgy, from the doctrine of heterogeneous equilibria to the atomic point of view, and the peculiarities and difficulties arising from this transition.

QUANTITATIVE ESTIMATION OF THE IMPURITIES IN TIN BY MEANS OF THE QUARTZ SPECTROGRAPH

By C. Stansfield Hitchen

The paper describes the application of the logarithmic wedge sector method of quantitative spectrography to the estimation of commonly occurring minor impurities in crude and refined tin. Both arc and spark methods of emission were employed and with the former a new device was used to overcome difficulties arising from the low melting point of the metal. The impurities investigated included antimony, arsenic, bismuth, copper, iron, lead, and zinc, their concentrations lying, in general, between 0.01 and 0.50 per cent. The results obtained show that the method may be usefully employed for the estimation of bismuth, copper, iron, lead, and zinc, in amounts ranging from 0.50 per cent to well below 0.01 per cent. Arsenic and antimony, however, could not be estimated in amounts less than 0.03 and 0.07 per cent respectively. Out of a total of 116 estimations by arc and spark emission, in 96 the errors were less than 5 per cent of the total quantity of the element present, whereas in the remaining twenty, the errors lay between 5 and 25 per cent. Spectro-analytical data for the several impurities studied are given in the form of tables, and curves correlating line-intensity with concentration have also been included.

ROBERT F. MEHL
Executive Committee

THE ROLE OF THE PLATINUM METALS IN DENTAL ALLOYS

By E. M. Wise and J. T. Eash

Section III—The Influence of Platinum and Palladium and Heat Treatment Upon the Microstructure and Constitution of Basic Alloys.

In a previous communication the improvement in strength, hardenability and color occasioned by replacing gold in a typical gold-silver-copper alloy by various amounts of platinum or palladium was discussed. In the present paper the results of further studies upon the constitution and the nature of the hardening transformation are presented. This research covers the following matters: (1) Relation of liquidus and solidus of the platinum and palladium alloys to the content of those metals; (2) Reduction of grain growth by platinum and palladium; (3) Isolation and study of the excess phase present in one of the high platinum alloys; (4) Determination of the domain of the phases responsible for the hardening of the palladium alloys; (5) Study of the Widmanstätten type of microstructure exhibited by the hardened gold and palladium alloys, and the troostitic appearance of the platinum alloys; and (6) X-ray diffraction studies to indicate the method of age-hardening of the alloys.

THE RATE OF PRECIPITATION OF NICKEL SILICIDE AND COBALT SILICIDE IN THE HARDENABLE COPPER-NICKEL-SILICON AND COPPER-COBALT-SILICON ALLOYS

By Curtis L. Wilson, Horace F. Silliman, and Eugene C. Little

The change in electrical resistance and Rockwell hardness (16-100-B) of copper alloys containing Ni_2Si and Co_2Si was determined by annealing the quenched solid solutions at various temperatures for various lengths of time. The rate of precipitation of Ni_2Si, as measured by the rate of decrease of electrical resistance and increase of hardness, increased with annealing temperature up to a certain point, depending on the percentage of Ni_2Si present. At these temperatures discontinuities in the rates of change occurred. Similar discontinuities in the Co_2Si alloys were noted. The solubility of Co_2Si in copper was found to be 5 per cent at 970 deg. C.

FABRICATION AND PROPERTIES OF SEAMLESS PHOSPHORIZED ARSENICAL COPPER TUBING

By G. L. Craig and O. Z. Klopsch

The fabrication characteristics and properties of phosphorized arsenical Lake copper have been compared with phosphorized prime Lake and phosphorized electrolytic seamless copper tubing, in a series of mill-scale tests employing commercial drawing schedules. Phosphorized arsenical coppers containing as much as 0.20 per cent arsenic were drawn with various reductions into ⅞ and ⅜-in. seamless tubing along with billets of the two types of arsenic-free copper. The effect of arsenic was determined by the average power required to draw given compositions and by the final properties of the respective

materials in the annealed condition and after various degrees of cold reduction. Power consumption data show that no more power is required to draw arsenical coppers of this type than the arsenic-free copper. The results of tensile tests indicate that arsenic increases the strength of cold-drawn tubing somewhat, but has no measurable effect on the properties of annealed tubing; the ductility of the tubing as evidenced by the elongation and other prescribed tests is unaffected by 0.20 per cent arsenic.

MACHINABILITY OF FREE-CUTTING BRASS ROD, II

By Alan Morris

In this paper are presented the results of cutting tests made on a pendulum operated milling-type machine, as described in a previous paper. Three series of samples of free-cutting brass rod alloy were tested in which the tin, iron and copper content were varied. The results of the tests indicate that (1) Addition of tin up to 0.25 per cent has little effect on hardness or resistance to cutting. Further increase in tin content to 0.75 per cent causes moderate increase in hardness and unit cutting energy. (2) Additions of iron up to 0.5 per cent are accompanied by a moderate improvement in cutting properties, but cause material hardening. (3) In well homogenized material, variation in copper content from 58 to 63 per cent has little effect on resistance to cutting. Increase of copper content from 63 to 65 per cent is accompanied by a moderate increase in unit cutting energy.

THE PRECIPITATION OF ALPHA FROM BETA BRASS

By Oscar T. Marzke

Four alloys which precipitate the alpha phase from the beta of the copper-zinc system were heat-treated in various ways to develop as many forms of the segregate as possible. It was found that the precipitate may have the form either of plates or of needles. Plates usually result when precipitation occurs at low temperatures and needles when precipitation takes place at high temperatures. The needles tend to aline themselves along certain planes in the matrix and to coalesce into plate-like structures. The two phases were found to be related so that a $\{ 111 \}$ plane and [011] direction of the precipitate are parallel to a $\{011\}$ plane and [111] direction of the matrix.

COMPARATIVE PROPERTIES OF OXYGEN-FREE, HIGH-CONDUCTIVITY, PHOSPHORIZED AND TOUGH-PITCH COPPERS

By W. R. Webster, J. L. Christie and R. S. Pratt

This paper supplements and continues the work recorded in a paper presented by the same authors in 1927, covering certain properties of tough pitch Lake and electrolytic and phosphorized electrolytic copper. It is brought out in the present paper that oxygen-free high-conductivity copper differs from the other coppers studied in several respects. The greatest difference, however, is in the much higher contraction of area values in the annealed condition, and the slight decrease in contraction of area values due to cold-drawing. These high values would indicate a greater possibility for continued cold-working operations than is found in either tough pitch or phosphorized copper. Several other points of contrast between oxygen-free high-conductivity copper and the other types of copper have been brought out, notably the differences in scaling properties, the rate of softening in annealing and of grain growth.

A NEW THERMOCOUPLE FOR THE DETERMINATION OF TEMPERATURES UP TO AT LEAST 1800° C.

By G. R. Fitterer*

Investigators in the field of temperature measurement have long sought a thermoelectric couple fulfilling the following requirements:

1. It should be useful up to and including high industrial temperatures; i. e., 1000° to 1800° C.
2. Its thermoelectric variation with temperature should be linear and be maintained after heating to high temperatures for long periods of time.
3. It should be reproducible; i. e., different couples of the same elements should have similar calibration curves.
4. Its thermoelectric power should be large so as to allow the industrial use of rugged recording instruments.
5. Chemical reactions with, and physical changes within the elements of the couple should not alter its calibration.

No thermocouple proposed to date exhibits simultaneously all of these characteristics, whereas the couple described in this paper fulfills all requirements to a satisfactory degree.

AN X-RAY STUDY OF COLD WORKED BRASS

By L. Thomassen and D. M. McCutcheon

Lattice distortions occur in strained surfaces of brass samples for compressive stresses considerably below the yield point.

Samples subjected to stresses only slightly above the yield point showed lattice distortion throughout the sample. The amount of distortion and fragmentation decreases rapidly below the surface for a short depth. From then on, very little change in the diagrams down to the center could be detected.

Fragmentation of the surface crystals begins immediately after stressing beyond the yield point.

Fragmentation becomes greater and goes deeper into the sample as the applied stress is increased.

Slip bands in the surface crystals are observed under the microscope in a sample subjected to a reduction of 2.44 per cent and increase in number and extend throughout the entire depth of the sample when the reduction has reached 4.13 per cent.

Indication of preferred orientation of the surface crystals is observed after a reduction of only 4.13 per cent.

On the basis of Zwicky's theories of secondary structures it is pointed out that the broadening of X-ray lines on cold working may be partly due to the formation of a mosaic structure.

EQUILIBRIUM RELATIONS IN ALUMINUM-MANGANESE ALLOYS OF HIGH PURITY. PART II.

By E. H. Dix, Jr., W. L. Fink, and L. A. Willey

This was the fourteenth of a series of papers from the Research Laboratories of the Aluminum Company of America reporting the results of investigations of equilibrium relations in aluminum base alloys of high purity. The purpose was to determine the phase relations in aluminum with aluminum-manganese alloys containing the smallest amount of iron that could be realized with the purest material available at the present time (less than 0.01 per cent iron).

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EQUILIBRIUM RELATIONS IN ALUMINUM CHROMIUM ALLOYS OF HIGH PURITY

By W. L. Fink and H. R. Freche

This was the thirteenth paper of a series from the laboratories of the Aluminum Company of America presenting the results of investigations of equilibrium relations in aluminum base alloys prepared from electrolytically refined aluminum. The ninth paper, "The Constitution of High Purity Aluminum-Titanium Alloys," presented a type of system which had not previously been encountered in aluminum alloys. Subsequent work has shown that there are several similar binary aluminum diagrams including that of aluminum and chromium. The present investigation was limited to the extreme aluminum end of the aluminum-chromium system.

OCCURRENCE OF IRREGULARITIES IN LEAD CABLE SHEATHING AND THEIR RELATION TO FAILURE

By William H. Bassett, Jr. and C. J. Snyder

A microscopic study of cable sheath failures in service was made and, except for corrosion, their causes can be classed as either mechanical or structural. Photographs showing various examples of service failures and the structure of adjacent sheath were shown.

The authors' method of study involved the microexamination of the failed sheath and the experimental reproduction of similar defects and structures. Experiments were performed using standard mill equipment. Micrographs show the type of weld responsible for split sheath, and how it was produced by permitting the lead kettle temperature to drop to 650 deg. F. or by the excessive use of lubricants in the lead container.

General structural irregularities were investigated by examining frequent cross sections throughout the pipe extruded by complete extrusion cycles. Variations in handling the lead and operation of the presses caused great differences in the structures noted. A series of nine macrographs shows dross streaks obtained under normal operation of a press when care is not taken to prevent and exclude oxides. The majority of the dross was found in the first quarter and last eighth of the pipe. For the contrast, the clean regular structure obtained when extreme care was taken to prevent and exclude oxides, was shown.

It was concluded that defective welds can be avoided by maintaining proper lead temperatures and avoiding excessive lubrication, and that most of the sub-oxide and all defects caused by inclusions of yellow oxide, dirt, etc., can be avoided by using good foundry practice in handling the lead.

HIGH CONDUCTIVITY OXYGEN FREE COPPER

By Sidney Rolle and P. H. Brace

Within the last two years, oxygen-free copper of high conductivity has been offered commercially, and its introduction marks a notable achievement in metallurgical progress. The electrical industry is using the new material in carload lots and even some of the tube manufacturers are adopting it in preference to phosphorus deoxidized copper.

Its most important uses thus far have been found to depend upon its ability to withstand severe or frequent bending. For example, coils in heavy duty electric motors and transformers made of ordinary copper are highly strained and not infrequently cracked in wrapping the rectangular strips or bars edgewise about a form. Wires in the motors of trains and street cars, copper cables between track joints in subway and elevated lines are subject to almost constant vibration which, all too rapidly, weakens them and requires replacement. Oxygen-free copper can be bent and twisted well beyond the limits that copper, with only a little oxygen, can stand, and appears to afford much longer life under conditions involving vibration.

It is also superior to ordinary copper in that it is practically impervious to the attacks of reducing gases at elevated temperatures, which permits oxygen-free copper to be welded or brazed without appreciable loss of strength.

As yet the United States Metals Refining Company, the producer of this material, is not ready to disclose completely, its casting procedure. It is said, however, that the new copper is made by melting in electric furnaces and casting the pure metal under specially controlled conditions.

The authors exhibited a number of commercial castings consisting of wire bar, cake and billet all vertically cast; also sections of these castings showing their macro-structure. Samples of copper were shown which had been spun into complicated shapes without intermediate anneals of any kind, showing the remarkable ductility of this material.

Other papers presented at the meetings were:

The Metastable Solid Solution Beta Prime of the Aluminum-Copper Alloys, by Nicholas Ageew and George Kurdjumov.

Diffusion of Hydrogen Through Platinum and Nickel and Through Double Layers of These Metals, by W. R. Ham.

GASES IN METALS

Two sessions were held on the subject of gases in metals. The sessions were held as a symposium with speakers giving their ideas from notes or extemporaneously rather than from manuscripts.

J. L. Christie spoke on **Gas-Metal Problems of the Brass Industry.** He showed lantern slides illustrating typical examples of what happens when gases are found in cast brass bars and slabs. He pointed out the importance of pouring brass at the correct temperature.

E. R. Darby presented some material on the **Gas-Metal Problems of the Non-Ferrous Foundryman.** He stated that gas appeared in foundry castings as a result of being introduced into the metal while said metal was entering the mold, and that the gas was trapped in the casting at the time of freezing. Sources of gases in castings, in addition to the above are: air, fuel, core binder, moisture in the mold and the charcoal cover of the melt. Mr. Darby's paper also stressed the importance of pouring at the correct temperature.

The discussion of both of these papers referred to the lack of fundamental data about gases in metals and their effects upon each other. It was stated that the so-called "deoxidizing" action of addition agents was often a misnomer; that what these addition agents really did was to change the comparative solubility of gases in metals in the melted and the solid state. It was pointed out that sulphur is one of the most important causes of porosity in copper; also that charcoal used as a cover on molten metal was likely to be one of the chief offenders in introducing

gases into the melt. The need was pointed out for a non-deleterious element to degasify copper.

Dr. C. H. Mathewson spoke on the **Interpretation of Gas-Metal Reactions in the Light of Phase Equilibria.** He confined himself to the theoretical aspects of the problem of gases in metals. The difficulty in this problem is the large number of variables due to the existence of such a large number of gases which can be absorbed by the melted metals and alloys. Dr. Mathewson described the development of theoretical equilibrium diagrams of metals and gases from data drawn from pressure-temperature-concentration curves.

Other papers presented at these sessions were as follows:

A General Analysis of the Gas-Metal Problem by Dr. John Johnston.

An Evaluation of Theoretical Methods for Determining Gases in Metals, by P. H. Brace.

On page 98 will be found abstracts of three additional papers.

The Casting of Two Huge Doors in Bronze

By F. H. LANDOLT

Penn Brass and Bronze Works, Brooklyn, N. Y.

THERE was recently cast, in one of the leading bronze foundries in this country, a pair of doors, two leaves to the pair, measuring 22′0″ long x 13′6″ wide, with a 4″ return on all sides. Each casting weighed approximately 5,000 pounds, cast in one piece, without any openings, with a mean thickness of ⅜″. The face, or front side of the door, was of a highly ornamental design, consisting of molded effects, deeply recessed panels, and other highly ornamental features. All these were cast as an integral part of the design and were not applied subsequently.

The mold was made direct from the plaster models, as submitted by the sculptor, the necessary shrinkage and finishing having been provided for when making up the models.

Considerable preparation was made to insure success. Special flasks were built of cast iron parts, wrought iron parts, and heavy spruce timber. The drag side measured some 9″ in depth, the cope side being of like dimension. Ample space was provided in the mold for the pattern, to permit same being poured by a series of basins. These basins were thirteen in number, in a straight line, close to the long side of the flask, risers being provided on the opposite side, and a run-way provided through the center to facilitate filling the basins with the molten metal and eventually pulling the plugs to permit the metal to flow into the mold. All the metal was melted in the usual crucible furnace, in conjunction with a small cupola, which was brought into use to provide sufficient metal. When all the metal in the various furnaces had reached the pouring temperature, it was conveyed to the various basins and poured into them. This work having been completed, the men provided with protective clothing, were stationed at each basin, and at the given word each pulled a plug in the respective basin opposite which the operator stood. When all was ready, the signal was given, and the thirteen plugs were pulled with military precision. The metal flowed into the mold at an even pace, the risers came up in due time, and the pouring was over.

In the course of one hour's time, the cope side was lifted up, the casting lifted out of the mold, cleaned off in the usual manner, and submitted for inspection. Upon close inspection, the casting revealed itself to be perfect in every detail. In spite of its immense size there was no scabbing, no steam holes, no straining, and the surface on both sides, front and back, was as perfect as it could be possible to get.

It is believed that for work of this character, this is the largest casting ever produced. Great credit is due to the William H. Jackson Company, of New York, for having undertaken to perform a requirement made by the architect.

The doors swing very easily, being opened and closed daily. They are now in place at the Penn Mutual Life Insurance Company building of Philadelphia, Pennsylvania.

The doors were designed by Ernest J. Matthewson, architect, of Philadelphia and the sculptured work was performed by Joseph H. Bass of Philadelphia. The General Contractors were Doyle & Company of Philadelphia.

5,000-Pound Bronze Doors, Each Cast in One Piece.

Fluxes in Brass Melting

By WERNER FRÖHLICH
Brass Melter, Potsdam, Germany

A Review of the Many Fluxes in Use, Their Purposes and Their Limitations

THE fluxes usually employed in foundries and melting works may be classified as follows:

1. As an accelerator of the melting process.
2. As a protection against the oxidizing influence of the furnace atmospheres at elevated temperatures as well as against absorption of certain gases of combustion by the melt.
3. As an eliminator of metallic as well as non-metallic impurities such as iron, aluminum, sand, oxides, and gases.
4. As a reducing agent (by means of carbon, manganese, etc.).

Apart from the numerous patented special fluxes offered in the market, **glass or sand,** usually containing **carbon** in some form or other, are most frequently employed in the production of large quantities of brass (in reverberatories or large electric and oil furnaces) while **borax or boric acid** is often used in crucible melting (general foundry work). Occasionally, **plain charcoal** or **coke layers** are preferred, while another flux sometimes suggested for crucible work consists of **coke-salt (potassium chloride)** mixtures.

Charcoal or Coke

In recommending plain charcoal or coke layers it is sometimes pointed out that the zinc oxide produced tends to form a very dense mixture with the carbon layer practically impervious to the furnace gases. Another advantage of this mixture is claimed to be its property of flowing almost like a liquid at the high temperatures involved, thus exerting its protective influence even during the working of the metal (rabbling, stirring, etc.). These properties are fully effective only if the charcoal, coal or coke is used in a finely divided state.

One of the chief arguments offered against this carbon-zinc oxide mixtures is that at the high furnace temperatures the latter tends to act somewhat as a catalytic agent, taking up an excess of oxygen from the air and conducting it to the underlying metal. While this property of zinc oxide appears to be a well established fact the problem arises as to the action of the carbon contained in the mixtures. Indeed, the reactive capacity of this carbon and the carbon oxide generated should be entirely sufficient at brass furnace temperatures to take care of all the available oxygen transmitted by the zinc oxide.

Borax or Boric Acid for Removing Oxides

More important practically appears the problem of removal of the oxide inclusions from the melt. Experience has taught that effective cleaning of the metal from oxides can be attained with fused fluxes only (aided, of course, by deoxidizing agents). However, numerous recent laboratory and semi-practical experiments have shown that under certain conditions and with certain flux mixtures the reverse may hold true. Genders and Haughton[1] have found, for instance, that under the experimental conditions involved serious zinc oxide inclusions were actually induced by borax, calcium fluoride, etc., because of the tendency of the zinc oxide "wetted" by these fluxing agents to ball together directly beneath the surface of the metallic bath instead of rising to the top.

It is obvious that these and similar results did not remain unchallenged, many years of practical experience with borax and other boron compounds and mixtures having proven their purifying value too often and under too many varying conditions, to admit of the veracity of isolated experimental results. It is well known that where on using boron compound fluxes serious oxide inclusions are encountered this is most commonly due to such factors as low melting and casting temperatures, faulty pouring and casting methods, deoxidizing problems, etc. Also if the borax or boric acid cover is not carefully removed directly previous to pouring, some of the flux, saturated as it is with zinc oxide, will be washed into the casting, forming inclusions of exactly the type described by Genders and Haughton. In order to avoid this difficulty with very fluid slag mixtures it is recommended to dust some sand or fireclay powder over the slag cover which is then easily removed.

In working with reverberatory furnaces (for the production of large castings, melting down heavy or very light scrap, etc.), faulty pouring methods include chiefly: (1) the employment of the slit tap and (2) excessively high drop of the metal. In using slit tap reverberatories the metal is tapped from the surface, all the zinc oxide, ashes and slag accumulating on the metal being drawn into the pan. Besides, with a fixed position of the pan the drop of the metal will be considerably higher at the beginning of the pouring process. Best results are always obtained with bottom-tapped reverberatory furnaces where only clean metal is drawn from the bottom of the melt while the tapping level remains constant at all times. The trouble sometimes encountered in opening and closing the tap is a matter of experience and ability only. If as much care would be employed in closing bottom taps as is usually expended in tamping slit taps, tapping difficulties will hardly be experienced.

This short deviation from the main topic under discussion has been made to illustrate the fact that serious zinc oxide inclusions need not be due to the use of borax and some of the other slagging fluxes employed.

Apart from their direct action on zinc oxide and their protecting influence borax and boric acid slags exhibit a decided absorptive capacity for silicic acid (silica),

[1]Paper, Faraday Society, May, 1924.

alumina, lime, etc. There is also a noticeable effect towards subduing the loss of zinc by evaporation. While in melting brasses rich in zinc, a small addition of aluminum will greatly reduce this loss, a well balanced borax slag improves conditions still further.

Occasionally boric acid is used mixed with other fluxing agents such as crude sodium bicarbonate. The most common mixture of this type consists of one part of boric acid and three parts sodium bicarbonate, the quantity added varying from 0.25 to 1.00 per cent, depending on the amount of scrap material in the charge. Mixtures of borax and boric acid with calcined soda or calcined soda-potash are also used, their chief advantage over plain borax-boric acid fluxes being seen in their desulfurizing action on brass. It should be pointed out, however, that while the soda or potash contents of these mixtures—if they are intended to exert a real desulfurizing influence—must be maintained in some relation to the sulfur contents of the metallic bath, the proportion of borax or boric acid present is guided by entirely different considerations, so that perfect, and therefore satisfactory flux mixtures of this type are rather difficult to produce. It is advisable, therefore, to use a borax-boric acid slag during melting and superheating the metal, while for the purpose of desulfurizing this slag is replaced by a charcoal-calcined soda mixture directly previous to pouring. The desulfurizing influence of soda ash is not absolute, of course, although there is little agreement in regards to the actual degree of desulfurization. The author has reduced the sulfur contents of common brass from 0.15 to 0.05 per cent, other metallurgists have reached minimum sulfur contents of 0.03 per cent while under certain conditions it proved impossible to reduce the sulfur from 0.25 per cent to below 0.12 per cent by as much as three washings. Optimal conditions are: a shallow metallic bath, comparatively high temperatures, equal amounts by volume of calcined soda and powdered charcoal, and absolutely dry material.

It appears that in spite of its higher costs boric acid is steadily gaining on borax as a fluxing agent for brass alloys. Comparison of the relative prices with the percentage of active constituents in the two chemicals does not explain this fact. Borax contains almost exactly 50 per cent of water and 50 per cent of the active sodium tetraborate while at the elevated temperatures of the process boric acid is decomposed into the "glassy boric acid" (B_2O_3) and water:

$$2\,B(HO)_3 = B_2O_3 + 3H_2O.$$

Accordingly, the amount of active constituents in boric acid does not exceed 56 per cent.

There is quite a difference in the efficiency of the two reagents, however, the quantity of boric acid required to attain a certain absorptive or protective capacity being considerably smaller than that of a corresponding amount of borax, especially if it is employed mixed with sodium bicarbonate. It has been stated on good authority[3] that the solvent capacity of a mixture of one part of boric acid and three parts of sodium bicarbonate is larger quantitatively and qualitatively than that of straight borax. Now if the price of boric acid in the international market is £22. per ton (August 10, 1931), and that of sodium carbonate £10.10 the price per ton of the mixture is about $65 as against $70 in the case of straight borax.

A very important practical advantage of boric acid as a fluxing agent is its lack of hygroscopy as compared with borax which absorbs water with great avidity and which for best results requires drying previous to use unless it is kept in water tight containers. Drying of borax is best carried out by heating the salt gradually to 200° C (400° Fahr.). Part of the borax is dried by placing it in the crucible or furnace previous to adding the charge.

[3]Private correspondence.

Glass for Metal Covers

A very cheap and quite effective slag cover for all common brass alloys are sand-soda mixtures or glass scrap. Plain sand is also used for this purpose but on account of its high melting point, its high degree of viscosity and its general sluggishness at the temperatures involved sand straight can hardly be considered a suitable brass flux. Where glass scrap or similar industrial residues may be had cheap no better fluxing material can be imagined. It exhibits a strong solvent power for oxides, silicates, and—to some degree—for aluminum. Its covering capacity is as good as that of the borates, while if mixed with sufficient quantities of powdered charcoal it exerts a strongly retarding influence on the evolution of zinc vapors. It is peculiar that bottle glass, particularly of the green variety, is easily the best of all the mixtures. In crucible melting the glass may be placed in the crucibles before adding the charge. If sufficient quantities of cheap glass are not available, sand-soda mixtures (50:50) will do.

Carbonate Fluxes

There are a number of flux mixtures calling for sodium or potassium carbonate as chief constituents. A mixture of these two carbonates exerts a much greater solvent action than either constituent alone. However, since potash is almost twice as expensive as soda (calcined) these mixtures always contain an excess of the latter. Apart from their satisfactory fluxing action in general these mixtures possess strong absorptive capacities for sulfur and sulfides. Their most important and practically deciding disadvantage is their corrosive influence on furnace and crucible walls. Due to the affinity of these strongly alkaline reagents for silica, they will absorb this until their affinity is satisfied, the absorptive capacity for metallic oxides increasing in the same degree. Thus it is obvious, that glass mixtures are more advantageous in the first place, while the strongly alkaline reagents should be used only for decreasing the sulfur, iron and arsenic contents of brass.

Wherever for some reason fluxes or slags are desired to contain sodium, sodium bicarbonate should be added which is equally satisfactory for brasses rich in copper, zinc or tin. For brass alloys rich in lead, mixtures of talcum, $Mg_3H_2(SiO_3)_4$, and quartz powder are being recommended; fluxes containing borax or boric acid as chief ingredient should not be employed for this purpose.

Mixed Fluxes

There are a few old recipes for brass fluxes using alkaline carbonates, one of the most common being a mixture of potassium carbonate and moistened sawdust. Occasionally powdered fluorspar is also added to this mixture. There is nothing to recommend a mixture of this type. Apart from the relatively high costs of potassium carbonate and its strongly corrosive action on refractory materials there is the moist sawdust which can fill no useful purpose whatever. Charcoal is a much more efficient reducing agent while moisture should be avoided in any alkaline flux. Admixture of fluorspar has its advantages. The adsorption power of the slag for impurities as well as its affinity for sulfur is strongly increased.

Another flux mixture recommended in England consists 5 parts crude sodium carbonate, 15 parts quartz sand, 5 parts ground anthracite, and 20 parts of bone ash. This composition offers nothing out of the ordinary. It is possible that under the strongly reducing and thermal conditions of the process bone ash exerts an influence similar to that of plaster of paris, another calcium compound.

This article will be continued in an early issue.—Ed.

Sheet Metal Workers' Problems

By W. B. FRANCIS
Associate Editor

Q.—How can we estimate the amount of stock that will be required to make a given number of drawn work pieces?

A.—Your query is a very practical one, and it can be answered best by a series of actual problems. File these estimates in your note book for ready reference. Then with a little practice with these solutions you can learn how to produce quickly the data needed for ordering stock. Furthermore, this data must be used to make the cutting dies and to figure the costs when bidding for contract work.

The size of stock for cylindrical work, whether for shallow or deeper forms, such as for lids in the shallow class, and for pans of the deeper kind, is estimated as follows:

First, find the area of the circular bottom, which is equal to the square of its diameter multiplied by .7854. Thus, if the diameter of the vessel in Figure 1 is 7 inches, the area of its bottom is $7 \times 7 \times .7854 = 38.5$ square inches.

Second, find the area of the shell forming the body of the vessel, which is equal to the circumference multiplied by its height; and this circumference is equal to the diameter multiplied by 3.1416.

Thus, if the vessel, Figure 1, is 5 inches deep, the area of its shell is $7 \times .7854 \times 5 = 110$ square inches. The total area of the stock in the vessel is 38.5 plus 110 = 148.5 square inches.

To find the diameter of a circular disk having the area of 148.5 square inches, this diameter is equal to the square root of the area divided by .7854. Thus, for the metal in Figure 1, the diameter equals $\sqrt{148.5 \div .7854} = 13\frac{3}{4}$ inches. A test disk of about 14 inches would be given a trial in the dies in order to find how it would draw and trim. Then if any stock could be saved, this allowance would be made before making the cutting dies.

Circles of 13¾ inches would be laid off on sheets of standard widths, and with a margin all around them so as to insure cutting out perfect pieces, and the number of these circles per foot of stock counted. Then by referring to the table of weights in the sheet metal gauges, the pounds of stock can be quickly estimated.

In using sheet metal gauges and tables it is necessary to distinguish between those for steel sheets and for nonferrous metals. Thus, for sheet steel the U. S. Standard gauge is used. Furthermore, the weight of stock varies according to the method of manufacture. For cold rolled strips or sheets, the weight per square foot equals the width multiplied by the length and this product by the thickness in inches, and by 42.04. For hot rolled steel strips and sheets the multiplier is 41.412. If the stock has been resquared, the multiplier for the net area is 40.8.

The following example illustrates the use of the U. S. Standard gauge. A 1/16-inch steel sheet, which corresponds to the No. 16 gauge, and of the ordinary hot rolled stock weighs 2.59 pounds per square foot. The American, or Brown & Sharpe, gauge is used for nonferrous metals except zinc. The thickness of this gauge is less than for the same numbers of the U. S. S. gauge. As stated above, the No. 16 U. S. S. gauge for steel is 1/16-inch, or .0625 inch. On the other hand the nonferrous metal No. 16 B & S sheet gauge is .0508 inch thick. Then of course, the weights of nonferrous metals vary greatly, so that a complete weight gauge is needed by the estimator. All these gauges can be obtained from the producers of the various sheet metals.

For flat aluminum sheets, No. 16 B & S, or .051 inch, the weight per square foot is .71 lb.; for 18 per cent nickel silver, such as used largely for the base metal to be silver plated, as for table ware, No. 16 B & S weighs 2.314 lbs. per square ft.; for high brass No. 16 B & S, the weight is 2.38 pounds per square ft.; etc.

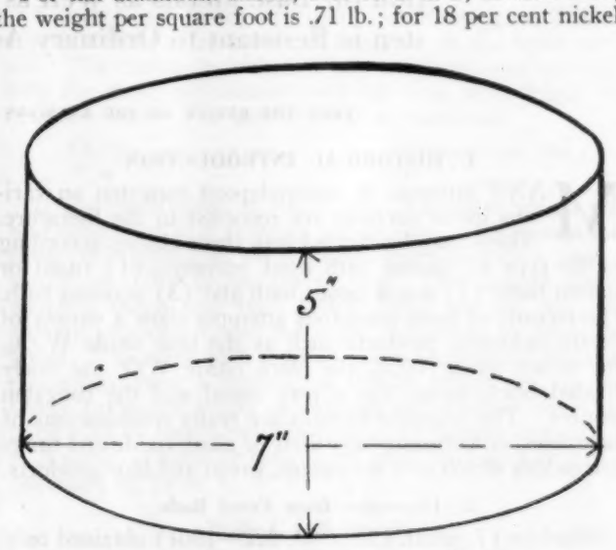

Fig. 1. Sheet Metal Cylinder to Calculate.

The sheet zinc gauge is individual, and ranges from No. 1, or .002 inch, up to No. 28, or 1.000 inch thick. The weight of the zinc sheet No. 24, or .125 inch, is 4.7 pounds per square foot. As stated above, a complete set of sheet metal gauges is needed by the estimator.

Black Dips

Q.—We are interested in getting a jet black dip on copper, also on 85-15 low brass.

A.—To obtain a jet black color on copper, we would suggest the use of a sulphide solution made of liquid sulphur 1 oz., water 1 gallon. The work should be clean before dipping into the sulphur solution, and if the color is not uniform, it will be necessary to scratchbrush the work and probably dip it in the sulphur solution a second time and scratchbrush again.

For the low brass use an arsenic solution made of white arsenic 1 oz., sodium cyanide 6 ozs., water 1 gallon. Use the solution at or near the boiling temperature, and the addition of a small amount of 26° ammonia (about ¼ pint to a gallon of the dip solution) helps the operation of the dip in producing a jet black.

The work must be chemically clean before placing into this dip solution to produce an even finish.

OLIVER J. SIZELOVE.

The Electrodeposition of Tungsten from Aqueous Alkaline Solutions

By M. LESLIE HOLT and LOUIS KAHLENBERG

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It Is Quite Commonly Recognized That a Satisfactory Coating of Electroplated Tungsten Would Be Specially Valuable as a Protection for Base Metals as Well as for Ornamental Purposes. Tungsten is Resistant to Ordinary Acids and Other Chemical Reagents

FROM THE REVIEW OF THE AMERICAN ELECTROPLATERS' SOCIETY, JANUARY, 1933.

I. HISTORICAL INTRODUCTION

MANY attempts to electrodeposit tungsten on various metal surfaces are recorded in the literature. These may be divided into three classes according to the type of plating bath used, namely—(1) fused or molten bath, (2) non-aqueous bath and (3) aqueous bath. The records of these numerous attempts show a variety of electro-reduction products such as the blue oxide W_2O_5, the brown oxide WO_2, the black oxide WO, the finely divided black metal, the silvery metal and the tungsten bronzes. The so-called bronzes are really combinations of the oxides, or various proportions of alkali oxide and tungsten oxides which give the purple, green and blue products.

1. Deposition from Fused Baths

Schiebler (J. prakt. Chem. 83, 322—1861) obtained only tungsten bronze upon electrolysis of various fused tungstates. Zettnow (Pogg. Ann. 130, 16—1867) used a bath of molten sodium tungstate and obtained a black powder which he said was metallic tungsten. Hallopeau (Compt. rend. 127, 755—1898) electrolized fused lithium para-tungstate and noticed crystals of tungsten at the cathode. Stavenhagen (Ber. 32, 3064—1899), however, obtained only a lithium tungsten bronze from the same bath. Knorre (J. prakt. Chem. N. F. 27, 58—1883) also obtained tungsten bronze deposits from molten tungstates. Martin (Z. anorg. Chemie 65, 311—1910) obtained a deposit of tungsten from a bath of molten cryolite in which was dissolved some tungstic acid. Van Liempt (Z. anorg. Chem. 122, 175—1922; Z. anorg. Chem. 143, 285—1925; Z. Elektrom. 31, 249—1925) used baths of fused lithium and sodium tungstates in which tungstic acid was dissolved and obtained deposits of tungsten as well as some tungsten bronzes. Mann and Halvorsen (Trans. Am. Electrochem. Soc. 45, 13—1924) used a bath of fused lithium chloride with a tungsten anode and secured cathode deposits containing tungsten. Kahlenberg (Trans. Am. Electrochem. Soc. 46, 181—1924) used a fused bath of sodium and potassium chlorides in which tungstic acid was dissolved and obtained, under certain conditions, good deposits of tungsten. However, these deposits were quite thin. L. Andrieux (Ann. Chim. (10) 12, 423—1929) deposited metallic tungsten by electrolysis of tungstic acid dissolved in fused alkali borates and fluorides. Hartmann (Ebert & Bretschneider Z. anorg. Chem. 198, 116—1931) used baths of fused alkali phosphates and tungstic acid and deposited both alpha and beta tungsten in metallic form as shown by Röntgenographic studies.

2. Deposition from Non-Aqueous Baths

Rosenheim (Z. angew. Chem. 22, 1153—1909) electrolized a solution of tungstic acid in alcohol saturated with hydrochloric acid gas and obtained only a lower valence tungsten salt. A German patent (German patent No. 231,657—1910) describes the deposit of tungsten from pertungstic acid in various solvents. Fischer (Z. anorg. Chem. 81, 170—1913; Z. anorg. Chem. 81, 102—1913) failed in his attempts to electrodeposit tungsten by the method described in this patent. Another German patent (German patent No. 237,014—1920) describes the deposition of tungsten from solutions of tungsten salts in such solvents as acetone. Fink (Trans. Electrochem. Soc. 59, 461—1931) failed to get results from the mentioned solutions in this patent and also from those of the earlier patent. Neumann and Richter (Z. Elektrochem. 30, 474—1924) tried electrolysis of tungsten hexachloride in acetone, pyridine and glycerine respectively with no results. Mann and Halvorsen (loc. cit.) also attempted to electrodeposit tungsten from solutions of the hexachloride in organic solvents. McKee and Mann (McKee, Mann & Montillon, Trans. Am. Electrochem. Soc. 53, 533—1928) used ammonium iodide in furfural as the electrolyte with a tungsten anode and a copper cathode with no result. L. St. C. Broughall (British patent 320818—1928) electrolyzed a solution of a tungsten salt in liquid ammonia at a low temperature or a high pressure. Booth and Merlub-Sobel (J. Phys. Chem. 35, 3303—1931) failed to deposit tungsten from a solution of tungsten penta-bromide in liquid ammonia. They also tried potassium iodide as an addition reagent for the above solution.

3. Deposition from Aqueous Baths

M. Junot (L'Inst. 97—1853—Mellor Vol. XI. p. 692) reduced tungsten electrolytically from a solution of a tungstate in potassium cyanide and alkali hydroxide. Smith (Ber. 13, 753—1880) made the observation that the electrolysis of a neutral solution of a tungstate yields no result, while the acid solution soon becomes blue. Frere (Bull. Soc. Chim. 19, 213—1898) obtained a tungsten amalgam by electrolysis of a hydrofluoric acid solution of tungstic oxide using a mercury cathode. Schaefer (Z. anorg. Chem. 38, 175—1904) electrolized aqueous solutions of sodium tungstate, potassium tungstate and ammonium tungstate and described the various tungsten bronzes obtained. Lieser (Z. Elektrochem. 13, 690—1907) used an acid solution of sodium tungstate with a nickel anode and a platinum cathode and obtained a blue solution containing

W_4O_{11}. With a lead cathode he got the brown WO_2. Neither Fischer nor Fink (loc. cit.) could obtain tungsten from aqueous pertungstic acid solutions as claimed in a German patent (German patent—loc. cit. 1910). Reck (Thesis—see Mann & Halvorsen, loc. cit.) tried electrolysis of aqueous acid solutions of ammonium tungstate and sodium tungstate and also a solution of tungsten sulfide with no results. Pearson and Craig (Canadian patent 221041—1922) patented a method for deposition of tungsten from a cell with pasty tungstic oxide in the cathode chamber and sulphuric acid as the electrolyte. Neumann and Richter (loc. cit.) electrolized aqueous double oxalates and double cyanides of tungsten and obtained only the lower oxides. Collenberg and Nillson (Z. Elektrochem. 31, 555—1925) obtained pentavalent tungsten upon electrolysis of an oxalic acid solution of potassium tungstate. Jackson, Russell and Merrill (J. Chem. Soc. 2394—1929) formed a tungsten amalgam by electrolysis of tungstic oxide in 4.6 N-HF solution using a mercury cathode. Fink and Jones (Trans. Electrochem. Soc. 59, 461—1931) succeeded in depositing tungsten from hot alkaline solutions of the tungstates, a bath made by dissolving tungstic acid in saturated sodium carbonate solution being the best. Deposits so obtained on brass or copper cathodes were described as "silvery white" metal but very thin.

II. EXPERIMENTAL

1. Preliminary Work

The present investigation was confined to aqueous solutions entirely. We first tried various acid, neutral and slightly alkaline solutions—always with negative results insofar as electrolytic reductions to the metal was concerned. In acid baths the cathode solution became blue, in alkaline it was brown or blue and in neutral solutions there was no particular change in color. The cathode itself was usually coated with a purple or green bronze. In general, the resistance of the various solutions was high so that there was very little current flow. In this preliminary work interest was centered largely on phosphoric acid solutions and slightly alkaline phosphate solutions, for upon addition of phosphoric acid to a sodium tungstate solution, tungstic acid does not precipitate out as is ordinarily the case when a mineral acid is added to a solution of an alkali tungstate. Various concentrations of boric acid, hydrofluoric acid and arsenic acid were also tried. However, the failure to obtain satisfactory results from these solutions, and the success with which Fink and Jones (loc. cit.) electrodeposited tungsten, led us to a further study of deposition from hot aqueous alkaline solutions.

2. Method and Procedure

In all the experiments the following method was used: Pyrex beakers, 100 c.c. size, served as the electrolytic cells. Two of these connected in series were put on a hot plate to keep the solutions at the proper temperature. Each cell was supplied with two 3 cm. by 3 cm. smooth platinum anodes and one cathode of the same size (usually of brass) all supported on an arrangement of ⅛-inch brass rods serving as bus bars. These rods were clamped—insulated—to two glass rod ring stands. Each electrode was cut to leave a narrow 7 cm. "tail," on the end of which was bent a loop for clamping to the bus bar. When in use each cell was covered with two half circle glass plates to minimize spattering and loss by evaporation. Direct current was supplied to the cells through a switch-board having the usual voltmeter, ammeter and variable resistance. All solutions were made up, heated to the boiling point, and then put in the "beaker cells" on the hot plate. All cathodes used were buffed, washed and then dried with clean filter paper. All switches were closed before the cathodes were put into the cells (two cells were always used together in series). When the "run" was completed the cathodes were taken out before the switches were opened and quickly washed free of the electrolyte.

3. Various Alkaline Solutions

The first step was to check our method and procedure by using the baths and conditions suggested by Fink and Jones. The bath contained,

NaOH	70 grams per liter
WO_3	30 " " "
Dextrose	60 " " "

It was electrolized for 15 minutes at about 90°C with a current density of 10 amperes per sq. dm. The brass cathode (weighed before and after deposition) showed a gain of about 0.0015 gram per sq. dm. of surface—the total area of the 3 cm. by 3 cm. cathode being 0.18 sq. dm. However a bath made up of

NaOH	60 grams per liter
Na_2WO_4	38 " " "
Dextrose	60 " " "

and electrolized under the same conditions gave little if any indication of a deposit of tungsten on the brass cathode. The carbonate bath of Fink and Jones was undoubtedly the most satisfactory and this was accordingly the next one tried. The bath as made up contained

Na_2CO_3	330 grams per liter
WO_3	100 " " "

It was electrolized at 100°C for 15 minutes with a current density of 21.6 amperes per sq. dm. This gave a nice silvery tungsten coat on the brass cathode with a gain in weight of 0.019 grams per sq. dm. This deposit clearly weighed much less than 0.078 gram per sq. dm., the amount reported under the same conditions by Fink and Jones. The same bath used 24 hours later under the same conditions gave a deposit of 0.0155 gram per sq. dm. Other carbonate baths of varying composition were also tried with no better results—that is, no thicker deposits.

A series of alkaline baths were tried next with results as indicated in Table 1.

Table I. Alkaline Baths

Time 20 min. Temp. 90° C. Current 8.8 Amps. per sq. dm.

ALKALINE AGENT	GRAMS PER LITER	WO_3 GRAMS PER LITER	CATHODE APPEARANCE AFTER ELECTROLYSIS
NaOH	106	50	Nice shiny deposit
Na_2AlO_2	conc.	50	Fairly nice deposit
$Na_2Al_2O_4$	200	20	No deposit
Na_2AnO_2	conc.	50	Thick dull gray deposit (mostly Zn.)
Na-oleate	conc.	20	No result—too much foam
$Na_3PO_4.12H_2$	300	100	Nice shiny deposit
Na-benzoate	conc.	20	Thin purple green bronze
Na-salicylate	conc.	25	No result—WO_3 does not dissolve
Na-succinate	conc.	25	Cathode somewhat dulled
Na_2S	250	40	Thin purple blue bronze
"Metso"	200	125	Thin shiny deposit—slightly blue
Borax	sat.	70	Purple green coloration
K-tartrate	150	60	Loose black deposit
Rochelle Salt	150	60	No deposit
K-citrate	300	60	No deposit
Na_2WO_4	sat. 25°	70	No deposit
Na_2SnO_2	conc.	50	Thick granular deposit (Mostly Sn.)

Undoubtedly the WO_3 dissolves in these alkaline solutions as alkali tungstates. Of the baths shown in Table I. that made up of $Na_3PO_4.12H_2O$ plus WO_3 gave the best results. The "Metso" bath ($Na_2SiO_3.5H_2O$) gave nice deposits but they were badly contaminated with iron and consequently unsatisfactory. The other baths which gave no good deposits were greatly improved by being made strongly alkaline with 10 per cent NaOH solution. Sodium benzoate, salicylate, and succinate, are but slightly alkaline and became acid to litmus when WO_3 was added.

Potassium tartrate, rochelle salts and potassium citrate, should not be classified as alkaline agents.

In all the baths of Table I, WO_3 was the source of tungsten. Several baths were tried using $Na_2WO_4.2H_2O$ instead of WO_3. Saturated Na_2WO_4 alone gave no deposit but Na_2WO_4 added to a concentrated borax solution gave a thin, slightly shiny deposit. A concentrated Na_3PO_4 solution to which was added Na_2WO_4 also yielded a slight deposit.

4. The Na_3PO_4 + WO_3 Bath

The above mentioned work showed that the Na_3PO_4 + WO_3 bath gave the best results, so a study was made to find the conditions which yielded the greatest amount of deposit. The bath was made by dissolving the Na_3PO_4-$12H_2O$ (Baker and Adamson C. P.) in hot water, adding the weighed amount of WO_3 and heating until the solution was clear. This resulting solution, although clear, unless an excess of WO_3 was added, was always tinged yellow. During the addition of the WO_3, ammonia was constantly liberated due to the decomposition of the ammonium salts present in the WO_3 (General Chemical C. P.) by the alkaline solution. First a series of runs was made with a bath containing 350 grams per liter of the phosphate and varying amounts of WO_3. The results are shown in Table II.

Table II. Effects of Varying Amounts of WO_3 in a Phosphate Bath (350 g. per l)

Temp. 90°C, current 11.1 amps. per sq. dm., time 15 min.

ADDED WO_3 GRAMS PER LITER	CATHODE GAIN GRAMS PER SQ. DM.	APPEARANCE OF THE CATHODE
20	0.0011	purple red
40	0.0016	darker purple
60	0.0022	nice "silvery" deposit
80	0.0055	"silvery"—slight blue
100	0.0061	"silvery" more blue
120	0.0077	yellow red bronze
160	0.0066	dulled brass
200	0.0061	dulled brass

Then a series of runs was made using a more concentrated bath, 500 grams of $Na_3PO_4.12H_2O$ per liter, and varying amounts of WO_3. Conditions were kept the same. The results are shown in Table III.

Table III. Effects of Varying Amounts of WO_3 in a Phosphate Bath (500 Grams per Liter)

Temp. 90° C. current 11.1 amps. per sq. dm. time 15 minutes.

ADDED WO_3 GRAMS PER LITER	CATHODE GAIN GRAM PER SQ. DM.	APPEARANCE OF THE CATHODE
20	no gain	some purplish bronze
40	0.0026	shiny blue red
60	0.0033	shiny—slight blue
80	0.0072	nice "silvery" deposit
100	0.0082	nice "silvery" deposit
120	0.0066	nice "silvery" deposit
160	0.0061	dulled brass
200	0.0066	dulled brass

In all cases the above solutions (Tables II. and III.) were made up fresh as they were needed. The results indicate that the bath should be made up in about the proportion 4 parts by weight of $Na_3PO_4.12H_2O$ to 1 part by weight of WO_3 in not too large volume of water. Another extremely concentrated phosphate bath was made up. It contained 300 grams of $Na_3PO_4.12H_2O$ and 100 grams of WO_3 in a total volume of only 400 c.c. This solution when electrolized for 20 minutes with 2.2 amps. per sq. dm. at 100°C yielded a cathode gain of 0.0305 gm. per sq. dm. but the deposit was very dull. A fresh solution of the same concentration electrolized with 10 amps. per sq. dm. gave no deposit. The above mentioned deposit was the thickest obtained from a phosphate bath but did not compare in appearance with the usual good "silvery" deposit of about 0.020 gm. per sq. dm.

In order to find the best current density, a bath was made up and used with different current densities. The bath contained

100 grams $Na_3PO_4.12H_2O$
30 grams WO_3
150 c.c. total volume

The results are shown in Table IV.

Table IV. Effect of Current Density—Temp. 90° C, Time 20 Min.

AMPS. PER SQ. DM.	CATHODE GAIN GRAM PER SQ. DM.	APPEARANCE OF THE CATHODE
9	0.0244	nice "silvery" deposit
20	0.0266	nice "silvery" deposit
42	0.030	nice "silvery" deposit

Lower current densities gave proportionately lower cathode gains. Undoubtedly the best current density is about 10 amps. per sq. dm., as the increased gain in weight does not warrant the larger increased current. Of course, the current efficiency in all these depositions is very low, much less than 1 per cent—liberation of oxygen and hydrogen using most of the current.

Various metal cathodes were next tried with a phosphate bath containing 100 grams $Na_3PO_4.12H_2O$ and 18 grams WO_3 in a total volume of 200 c.c. (a fresh solution was used for each different cathode). The results are shown in Table V.

Table V. Various Cathodes Used with a Phosphate Bath

Time 20 min. Temp. 90° C

CATHODE USED	CATHODE GAIN GRAM PER SQ. DM.	APPEARANCE OF THE CATHODE	AMPERES PER SQ. DM.
Brass	0.0082	"silvery" deposit	22.2
Cadmium	0.0072	dulled and darker	22.2
Copper	0.0082	"silvery" deposit	22.2
Chrom. steel	0.0085	no change	22.2
Iron	no gain	red purple bronze	21.1
Molybdenum	no gain	dulled somewhat	22.2
Nickel	0.0040	no change	22.2
Tin	no gain	no change	22.2
Tungsten	no gain	dulled somewhat	7.

The results in Table V show that tungsten can be suitably deposited on brass, copper or chromium steel cathodes.

All the phosphate baths became nearly worthless after being used a few times and the yellow tinge of the fresh solution was completely gone. These old, used solutions gave only poor very thin colored deposits or merely a tungsten bronze on the cathode. Attempts to improve such baths by addition of various amounts of Na_3PO_4 or WO_3 or both were not successful. Table VI shows the results of attempts to improve a bath—original bath containing 300 grams $Na_3PO_4.12H_2O$ and 100 grams WO_3.

Table VI. Attempts to Improve a Phosphate Bath

Brass cathodes, 5 amps. per sq. dm., time 30 min., temp. 90°.

	BATH COMPOSITION	TOTAL VOLUME	CATHODE GAIN CELL NO. 1	CATHODE GAIN CELL NO. 2	CATHODE APPEARANCE
A	Original	400 c.c.	0.0056 gm.	0.0054 gm.	dull brassy
B	A 10 gm. Na_3PO_4	550 "	0.0052 "	0.0051 "	dull
C	B+25 gm. WO_3	525 "	0.0029 "	0.0029 "	nice "silvery" dep.
D	C+75 gm. Na_3PO_4	650 "	0.0022 "	0.0020 "	nice "silvery" dep.
E	D evaporated	500 "	0.0014 "	0.0017 "	fairly good dep.
F	E boiled with H_2	500 "	0.0008 "	0.0008 "	thin poor dep.
G	F evaporated	275 "	0.0004 "	0.0003 "	thin streaked dep.

It is necessary to use hot solutions—no deposit being obtained from a cold bath.

The liberation of ammonia from the freshly made phosphate solutions suggested the use of ammonia and ammonium salts as addition reagents to increase the thickness of the metal deposit. Most of the deposits made were very nice in appearance but so thin as to furnish very little protection to the base metal. Thus, means of securing better deposits were necessary. In this work the usual phosphate solution was used, with the two cells in series, one containing the addition reagent and the other serving as the control. Gain in weight of the two brass cathodes was recorded and difference in gain served as an index of the value of the added material. The results are recorded in Table VII. Conditions were maintained constant.

Table VII. Effect of the Ammonium Addition Reagents on Phosphate Bath

ADDED COMPOUND	RESULT
$(NH_4)_2CO_3$	no difference
NH_4Cl	no difference
$(NH_4)_2HPO_4$	less gain than control
$(NH_4)_2WO_4$	more gain than control
$P_2O_5.24WO_3+NH_4OH$	slightly more gain than control
$3NH_4OH.5WO_3$	brighter deposit than control

The experiments were merely qualitative in character and the observations made were nothing to warrant further study. Other added materials such as dextrose, potassium tartrate, rochelle salts, $KClO_3$ and NaCl were similarly tried with no particular improved result.

III. DISCUSSION

There is always the question as to whether or not this shiny metal deposit is really tungsten. When electrodeposited from a phosphate bath on a thin copper foil and dissolved in aqua regia, the tungsten is oxidized to the yellow insoluble WO_3. However the amount of WO_3 obtained by oxidizing the deposit was not as great as was expected from the amount of tungsten on the copper foil (that is the gain in weight of the cathode during electrolysis). The potential of a flat tungsten electrode (3 cm. x 6 cm. x .1 cm.) in N-KCl was .267 volts, that is the total combination

W (N-KCl)—Hg-Hg_2 Cl_2 sat. = .267 volts.

which was fairly stable, and the potential of the tungsten plated brass cathode in the same cell was fairly stable at .250 volt. This same potential was obtained from two cathodes, one plated from a carbonate solution and the other plated from the phosphate solution. All the deposits were so thin as to be immediately loosed from the base metal by HCl or HNO_3.

In all this work and in the work of Fink and Jones the deposits obtained were very thin. Seemingly a thin coating of the metal prevents any further deposition—a coated cathode gained only slightly (in weight) when used a second time in a new bath. The cathode gain was about the same whether the run was made in 15 minutes or 2 hours. That the used bath was still good was proved by getting a shiny deposit on a new brass cathode. Perhaps the reason for these thin deposits is that tungsten will not plate on tungsten. When a flat tungsten cathode was used in the phosphate solution it was somewhat dulled but showed very slight if any increase in weight. Again this bath was proved satisfactory by plating on a brass cathode from the second cell run in series.

The platinum anodes used in all work were apparently unaffected by the solutions—showing absolutely no corrosion. In individual runs they did not lose weight. Other anodes used include copper which was not affected, cadmium which was blackened and corroded, tin which was also blackened and corroded, and tungsten which was corroded and covered with a loose black residue.

No very satisfactory method was found for measuring the alkalinity of the solutions used. The hydrogen electrode potentials were quite unstable and very poorly reproducible. Indicator methods also proved quite unsatisfactory. Of course the addition of the acidic WO_3 to the NA_3PO_4 solution decreased the alkalinity in proportion to the amount added. Table VIII. gives fairly satisfactory results obtained by means of the hydrogen electrode—results that at least indicate the general trend of the alkalinity of the solution. Various amounts of WO_3 were added to 100 c.c. parts of a saturated $NaPO_4$ solution, then the pH* measured and the solution was used as a bath for deposition on a brass cathode.

Table VIII. Alkalinity of Phosphate Solutions and the Resulting Cathode Deposits

GRAMS WO_3 ADDED	pH OF SOLN.	APPEARANCE OF CATHODE DEPOSIT
0	12.5	no deposit
1	12.2	thin—"bronze"
2	11.6	thin—"bronze"
5	10.7	good—slightly blue
7	10.	very food shiny
10	9.2	nice deposit

Theoretically the deposition of tungsten ought to be an easy matter. At any rate, it should be no more difficult than electrodeposition of other metals. In reality, we find that it is an exceedingly difficult thing to accomplish. At best but thin films of tungsten are obtainable so far as we know. There is no adequate explanation for this. Indeed the experimental studies convince the laboratory worker that we are still very far from an adequate explanation of the phenomena of electrodeposition. The solution of this question is wrapped up with the question of the nature of the metallic state itself. Once the latter is solved, it will no doubt point the way to a new electro-chemistry and fundamental improvements in practical electroplating.

* The designation pH is an unfortunate one. It is used here only because it has become fairly common practice to do so, and the practical worker would find it more familiar than if the alkalinity were expressed in grams of basic "OH" per liter as should really be done.

Sand Casting Jewelry

Q.—Please tell me something about sand-casting jewelry; especially white gold.

A.—Nickel-alloyed white gold is more difficult to cast than ordinary yellow gold. The palladium-alloyed white golds are more likely to cast successfully, and while they cost more, their working qualities are so good that in many cases it pays to use them.

An excellent paper for the more experienced worker, entitled "Melting and Casting Some Gold Alloys," by Edward A. Capillon, was read at the February, 1930, meeting of the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers, of 29 West 39th St., New York City. (See METAL INDUSTRY for March, 1930, page 109, for an abstract.)

This article is an exhaustive treatise on melting and casting various gold and silver alloys, including sterling silver. It discusses the use of deoxidizers; that is, special substances which are added to the melt to make it cast properly. These deoxidizers are cheap and easy to use.

As you know, the dental profession makes extensive use of small gold castings. Dealers who sell dental golds will usually give their customers information.

Within the last few weeks we have seen articles in the papers regarding the Lenz processes of casting. Some years ago an artist of that name invented a method of making extremely delicate and beautiful castings, using many different metals, or even combining several metals in one casting.

Lenz died recently and his secret methods are to be published. Watch for this event. —J. W.

New York Platers' Meeting

THE New York Branch of the American Electroplaters' Society held its 24th annual meeting at the Aldine Club in New York on February 18th. A good attendance turned out and the members and guests were well rewarded as the technical session was unusually interesting and the banquet was a very pleasant affair.

President Liguori opened the educational meeting with a greeting, and then turned the chair over to Charles H. Proctor, Founder of the American Electroplaters' Society. The program is described briefly below.

G. A. Wilson of the New York Branch read a paper entitled **"Some Experiences I Have Had With Barrel Plating."** He described his methods of handling large production in a wide variety of finishes. He pointed out that one of the most important elements in barrel plating, just as it is in still plating, is thorough cleaning. He mentioned that he had done some work on barrel plating chromium, but could report no details.

Dr. C. L. Mantell delivered a talk on **The Development of Electroplating's Competitors.** Dr. Mantell had as one of his primary objects, stirring up a discussion about the economic situation in the electroplating industry. He warned platers that they are faced with competition, not only from the old sources, but also from a host of new developments, such as stainless steels, corrosion-resistant non-ferrous metals and alloys, cheap base metals with corrosion resistant coatings rolled on, spray metallic coatings, finishes by powdered metals, etc. Plating is endangered by the large amount of poor quality work turned out, thus leaving openings for other processes to go through and entrench themselves.

Several of the audience differed with Dr. Mantell as to the cause of this situation, pointing out that it was not the fault of the plater, but rather that of the manufacturer who was acceding to the demand for cheaper work by lowering his standards of quality. The discussion was warm and decidedly useful.

A. Wallace of the New York Branch read a paper on **Electrotyping and Its Relation to Electroplating.** Mr. Wallace described briefly the process of electrotyping, which is a specialized form of plating confined almost entirely to copper and nickel, for making printing plates. Some chromium is deposited, but only a very small percentage of the total work as nickel will stand several hundred thousand impressions, thus being suitable for almost any printing job which might arise.

Dr. C. L. Pan of the College of the City of New York gave a talk on **Measuring Minimum and Maximum Thicknesses of Electrodeposited Coatings.** He gave a very interesting blackboard demonstration and verbal description of the methods of determining thicknesses of electroplating coatings. He gave several formulæ as aids in the computations. He pointed out clearly the need for knowing accurately the efficiency of the plating solution and also described the means of determining said efficiency.

A MICROGRAPHIC STUDY OF THE DECOMPOSITION OF THE β PHASE IN THE COPPER-ALUMINUM SYSTEM*

By C. S. Smith and W. Earl Lindlief

The decomposition of an aluminum-copper alloy containing 11.87 per cent aluminum was studied microscopically by cooling samples directly from the β field in a salt bath maintained at constant temperatures below the eutectoid point (which has been redetermined as 570° ± 1° C.) and quenching after various periods of time. The change of microstructure occurring during reheating quenched samples was also studied. These conclusions were arrived at entirely by means of a microscopic study, but corroborative data were obtained from X-ray diffraction studies, hardness measurements and electrical conductivity determinations.

SEGREGATE STRUCTURES OF THE WIDMANSTÄTTEN TYPE DEVELOPED FROM SOLID SOLUTIONS OF COPPER IN ZINC*

By M. L. Fuller and J. L. Rodda

Well developed segregate structures of the Widmanstätten type which were produced by the segregation of the ϵ phase from the η solid solution of copper in zinc are studied crystallographically. Both phases have a hexagonal close-packed structure. The segregate forms as distinct plates parallel to the six matrix planes of the form [10.4]. On the basis of the theory of R. F. Mehl and C. S. Barrett and with the aid of some experimental observations, the orientation of the segregate relative to the matrix is hypothesized. The suggested orientation is such that (1) a [10.4] plane of the segregate is parallel to a [10.4] plane of the matrix; (2) the closest-packed directions in the two planes, which are at the same time directions of closest possible atomic packing in this type of lattice, are coincident; and (3) the principal axes of the segregate crystals are at 4 deg. to the principal axis of the parent matrix crystal. A mechanism for the segregation phenomenon is suggested.

THERMAL EXPANSIVITY OF ALUMINUM ALLOYS*

By L. W. Kempf

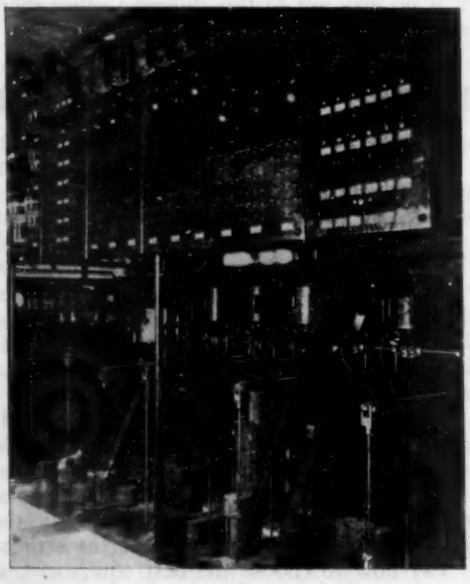
The thermal expansion of a number of aluminum alloys has been determined with an accuracy of ± 3 per cent. The variation in temperature of the relative amounts and distribution of the phases present in aluminum alloys is shown to be accompanied by volume changes of such magnitude as appreciably to affect determination of thermal expansivity to an extent dependent on the initial structural condition of the alloy. The magnitude of some of these effects has been determined. A table of the approximate coefficients of thermal expansivity of a number of commercial aluminum alloys is given.

* Abstract of a Paper Read at the Winter Meeting of the Institute of Metals Division, February 20-23, 1932. For a report of this meeting, see page 85.

Measuring Millionth-Inch Creep in Metals

WHEN hot, metals slowly yield under a steady pull, like taffy or cold tar, so P. G. McVetty of the Westinghouse Research Laboratory, patiently investigates this "creep" at high temperature by means of a long row of scientific apparatus. Automatically held at exact temperatures in individual furnaces, various samples carry heavy loads for months, while sensitive instruments, indicate changes of a millionth of an inch. Curves are plotted and the alloys best suited for turbines' blades are then selected.

Today steam turbines attain peripheral speeds at the blade tips of 15 miles a minute and operate at a temperature of over 800° F.



The Apparatus Developed by Westinghouse Research Laboratories for Determining Creep in Metals at High Temperatures

The testing for creep of steam turbine materials represents the highest order of sensitivity and accuracy in all details of the testing procedure. To measure creep rates of this order of magnitude requires not only the measurement of extremely small length changes but, precise measurement and control of temperatures.

While the creep test is the best known means of predicting the value of a material for high temperature service involving small permissible deformations, its limitations must not be ignored. At best, the length of a creep test is small compared to the time during which a material is expected to give satisfactory service. Extrapolation of creep curves is necessary but great care is essential if large errors are to be avoided.

It is generally agreed that creep is affected by the previous history of the material especially in the case of alloys which exhibit age-hardening tendencies. We may have, for example, a creep test in which the measured creep rate is negative because some structural change completely hides the creep. A more dangerous case is the one in which the creep is reduced to a small value during the test by age hardening. In this case the danger lies in the probability of an increased creep rate after the maximum age hardening effect is passed in service.

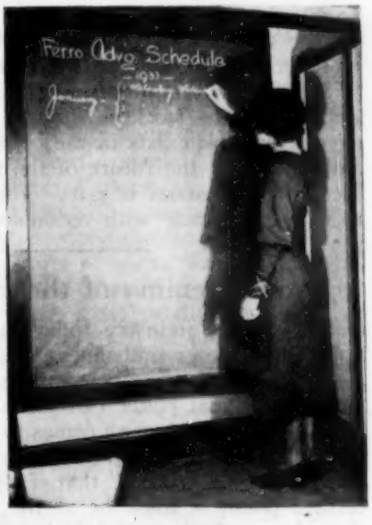
Neither the designer nor the testing engineer can extrapolate the creep curves with accuracy if internal changes in the metal are proceeding during the test and in subsequent service. This gives to the metallurgist a real problem in producing alloys which are not only resistant to creep but also structurally stable under service conditions of stress and temperature during their service life.

Super-Accurate Analysis

Less than a millionth of an ounce of iron can be quantitatively determined by a method employed in the General Electric Research Laboratory, Schenectady, N. Y. The metal is converted into ferric thiocyanate, a solution whose redness depends on the amount of iron dissolved. Ordinarily the redness is determined visually, but more accurate measurements have been made possible by use of the recording color analyzer developed in the General Electric Company's engineering laboratory.

Porcelain Enamel Blackboard

PORCELAIN enamel is rapidly being developed for many uses to which it has heretofore never been put. The Ferro Enamel Corporation, Cleveland, Ohio, is one of the chief experimenters in this work, and has lately developed a porcelain enamel finish for blackboards.



Porcelain Enameled Blackboard in Use at Offices of Ferro Enamel Coporation

According to Ferro, the blackboards have been developed for perfect functioning in schoolrooms, laboratories, and for business purposes such as, for instance, keeping advertising schedules (see illustration). A number of important advantages are claimed for the porcelain enameled product as compared with the slate blackboards that have been used in the past.

EDITORIALS

Metal Progress Continues

The recent meeting of the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers, reported on page 85 of this issue, convinced everyone who attended that there has been no cessation in the striving for improvement of products and methods in metal manufacturing, even after three years of ebbing tides of business. Here are examples.

Public announcement was made of a new high purity, high conductivity copper which is now being offered commercially. It is finding wide acceptance in the electrical industry and also among tube manufacturers in preference to phosphorus deoxidized copper. It seems to be extraordinarily ductile and to be able to withstand severe and frequent bending.

An important step forward was made in the study of gases in metals. Two papers of practical nature were given, one on the gas-metal problems in the rolling mill, and the other, in the brass foundry. A scholarly discussion was presented, blocking out the fundamental problems involved in studying gases in metals and laying a foundation plan for subsequent work to follow. We commend to the attention of the Institute, the continuation of its work on both the theoretical and practical aspects of this most important problem.

The improvement in analytical methods stood out in bold relief through a paper on the quantitative estimation of the impurities in tin by means of the quartz spectrograph. By employing the correct technique it is now possible to estimate bismuth, copper, lead, iron and zinc occurring as impurities in tin over such ranges as should meet ordinary industrial and commercial requirements. To our mind, it is only a question of time before a large part of the work now being done by the slower wet chemical methods, will be done by this rapid and perfectly practical procedure.

So long as this inquiring spirit exists among the rank and file of the workers, and so long as the broad courageous outlook exists in the organizations financing such investigations, the future of the non-ferrous metal manufacturing industries is safe. They are sure to return to their normal state with redoubled vigor.

The Dilemma of the Plating Industry

The plating industry today is being ground between upper and nether millstones. The market says, "Reduce costs!" The ultimate consumer says "Keep up Quality!"

No individual plater can solve this problem alone. If the head of his company comes to him and demands lower costs, he must comply. But he must never neglect to point out to the "boss" that if the costs are cut below a certain point, it must be at the expense of quality and that the marketing of inferior articles is certain to reflect upon the firm.

But is he to wage this war alone? It is impossible. The plater must have assistance, not out of sympathy or the kindly and charitable instincts of his associated and allied trades, but because it is imperative that the plating supply houses support the plater in this stand from a healthy self-interest. If plating is squeezed by other processes, the plating supply trades will feel the pinch immediately. They must protect the plater and the plating industry in order to save themselves.

There is only one answer to the question, "How?" By co-operative action. The job is of huge dimensions; it requires careful consideration and planning. But it must be undertaken without delay.

Needless to say, the one step in this direction which is being taken today must not be impeded. The industry must assure the continuation of the research on the corrosion resistance of electroplated steel, now being carried on by the American Electroplaters' Society, the Bureau of Standards and the American Society for Testing Materials. Further work must include plans for new processes and new equipment, but fundamental research must go on.

There is no way out of this dilemma other than by co-operative action.

The Plater—Practical or Technical?

The plater is having his troubles in these unhappy times. He is harassed by the low state of general business, by the advent of other processes striving to replace electroplating, by the demands of the public for higher quality of products, and by the necessity for producing his work at lower costs. In a word, the customer wants a dollar job for fifty cents or less, and the plater must satisfy him.

A brief description of the situation is that the public demands improvement from the plating industry, and the industry demands that the plater have a greater knowledge of his art. The day is gone when the rule of thumb plater could "get by." Today he must know his business from every angle. He must know: (1) what goes into his solutions; (2) what each ingredient does in its solution; (3) why these ingredients act as they do; (4) how to keep his solutions operating at standard efficiencies; (5) how to choose the best equipment, and the care and upkeep of that equipment.

The old-time plater faced by such demands immediately answered that they were unfair. How could he be expected to have such knowledge? And if he did, would he not be entitled to twice as much pay? Perhaps so. But the rights and wrongs, the morals and ethics of such demands are neither here nor there. The plater must know his art completely. If he does not, his function will disappear. His place will be taken by the mechanic to take care of the automatic equipment, and by the chemist who will keep his solutions in condition. Unskilled help will handle the work.

What can the plater do for himself? He cannot be a doctor of philosophy in chemistry, true enough, but the way is still open to him. He must learn first, the technique of controlling plating solutions by analysis; he must learn to analyze plating solutions. Then he must learn and understand the scientific principles underlying the practical operations which he performs daily.

Is this so difficult? Hardly. There is nothing mysterious or magical about the analysis of solutions. It does not call for genius. It requires only willingness and intelligence. Once the plater has mastered this technique he can fairly easily go on to the more basic scientific principles. After he learns what to do and how to

do it, he can then easily round out his knowledge by learning why these things have to be done.

The electroplater has one invaluable and unreplaceable asset—**practical operating experience,** If he adds to this treasure, the ability to exercise technical control and the knowledge of fundamental scientific principles, his place in industry is safe.

Modernization Pays

The idea of rehabilitating industry by modernizing equipment and facilities is gaining. It has cropped up in new and unusual places. Philadelphia has started a Renovize Philadelphia Campaign under the leadership of W. W. Atterbury, president of the Pennsylvania Railroad, who has already obtained pledges from citizens of Philadelphia and suburbs to spend more than $10,000,000 during the next six months. A similar committee has been named for New York under the direction of Grover A. Whalen, at the behest of Major General James G. Harboard, who is a member of the General Committee on Industrial Rehabilitation. Industrial plants are awakening to the possibilities of savings by improved equipment in "small" operations. For example, it saves money to use standard commercial parts made by automatic machines and processes; die cast parts to save machining; drawn shapes in various metals to save machining; welding to save riveting and other forms of building up; photo-electric controls for machine feeds and starting devices; the elimination of noise by the use of materials which have good shock absorbing qualities; the redesigning of old patterns when changing alloys, to allow for changed foundry properties; the increased use of tumbling to reduce polishing costs. These are only a few of the many small items involved.

Modernization is taking hold in large installations. The General Electric Company has stressed the idea that the right kind of modernization pays and furthermore, has carried out this principle in its own plants, installing a new million-dollar transformer-tank factory at Springfield, Mass,, and a four-million dollar outdoor, mercury steam plant at Schenectady; also modernizing the facilities for manufacturing motors at West Lynn, Schenectady, and Fort Wayne. The Ford Motor Company, Detroit, effected important savings by changing its direct current drives to the latest type of enclosed, alternating-current motors and control.

Instances could be cited without end. The moral is that those who operate obsolete equipment pay for modernization without getting it, through their higher costs of operation. The right kind of modernization pays for itself.

The Banks and Business

There is a strong feeling throughout in the land against our banks as they have been operated during the past year or two. They have not helped business as they should. They have used their aid from the Reconstruction Finance Corporation and the Federal Reserve Banks to solidify themselves, but have not passed on these benefits to their customers. In many cases they have even demanded payment of their loans from R. F. C. funds advanced to railroads.

If we go back of the facts and look for reasons, we have no trouble finding them. During the past four years, 5,738 banks in the United States have suspended payment, with liabilities of about $3,500,000,000. There in a nutshell is the whole story. But we who are outside of the banking field and do not pretend to tell banks how to operate their businesses, cannot help being struck with the fact that in our next door neighbor, Canada, there have been no bank failures whatsoever since 1923, in which year one failure occurred involving less than $20,000,000; the only one since 1914.

It is perhaps true that if the banks in the United States felt themselves stronger, they would be of more help to business. We cannot be sure of even this fact, however. The important thing is after all, their attitude. Do the banks at the present time help to finance orders? Yes. Do they help to finance modernization of equipment and facilities which will result in lowering operating costs? Not very often.

So we are taking the liberty of offering bankers a new idea in checking the desirability of a loan. In addition to calling for a financial statement showing proper financial solidity, it should be the bankers' practice to find out if the customer is operating at a profit or at a loss. How do his prices compare with his costs? Is he making money on his orders or is he taking business only to keep the wheels going at prices which are below his rock bottom costs?

We believe that it will not be long before banks find out that the latter consideration is as important as a financial statement. To be sure the business man will have to lay his cards on the table before the banker, but this is nothing new to anyone who has ever attempted to borrow money. It should result in more intimate and more effective co-operation between business and banks. Perhaps, conversely, some day depositors may have the right to ask for similarly intimate information from banks, to check the safety of their funds!

Industrial Planning

The old question of the value of science to mankind and the fundamental effect of the work of engineers upon human happiness, is still with us. In an unusually clear and understanding fashion, this question was discussed, and to the intelligent mind, settled, in an address by Frederick Laist, recently published in Mining and Metallurgy.

We call this the Machine Age with its mass production and complex, "mass" living. For this condition, unthinking blame the engineer. He is responsible for huge output and "big business." The simple life is gone forever and in its place we have strife, competition, breakneck speed, noise and general restlessness. Also, we have recurring periods of want amid plenty, side by side with luxury. Is the engineer responsible? Most certainly not.

Engineering has always been a servant of finance and government; a valued and indispensable servant, to be sure, and often well paid, but still a servant. The engineer's job is to build and produce the maximum possible with the minimum expenditure of labor. Distribution and consumption have been left to others.

We are learning now, that mass production is useless without mass consumption. We are beginning to realize that carefully planned production methods are of no avail unless they are correlated with consumption requirements. If people have no purchasing power they cannot absorb huge outputs, no matter how cheaply they are priced. We are beginning to realize also that there must be a fundamental change from the old policy of unrestrained individualism, resulting in thousands of hit-or-miss efforts, with their long train of failures, waste and suffering.

In Mr. Laist's words we need a realization that the true function of industry in all its phases is not to pile up riches for the few but to elevate the living standing of the many, and that this can be done best by controlled co-operation, rather than by the insane competition fostered by laws outgrown a quarter of a century ago.

When we have learned to control by rational plans, our huge and complex civilization, the engineer will be vindicated, and his ability to produce an abundance of human needs, will be recognized as a gift to humanity.

New Books

The Metals, Their Alloys, Amalgams, Compounds. By A. Frederick Collins. Published by D. Appleton and Company. Size 5 x 7½; 310 pages. Price $2.00.

This is a popular handbook for the layman and student, giving a "story" of the world's metals. It covers all of the known metals, common, precious, rare earth and radio-active. It also has a chapter on hypothetical metals, metals which men at one time believed to exist but later found to be non-existent.

The chapter headings are indicative: Common Metals; Noble Metals; Alkali Metals; Alkaline Earth Metals; Uncommon Metals; Rare Earth Metals; Radio-Active Metals; Hypothetical Metals; Older Alloys; Newer Alloys; What Amalgams Are; Uses of Metals.

It is a handy, simple book of considerable educational value.

For and Against Technocracy. Edited by J. George Fredericks. Published by the Business Bourse. Size 5½ x 8; 280 pages. Price $2.50.

This is a critical presentation of a subject which has caught, so quickly and widely, the public fancy or interest as the case may be. It is a symposium in which are joined men of prominence in various fields, some for and some against the tenets of Technocracy.

Whatever the opinion of the reader, he will find a full and complete presentation of both sides. The subject has taken such a hold on the public, even though it may be temporary, that everyone should have a reasonable knowledge of it.

Manufacturing Metal Statistics. By Charles B. Eliot. U. S. Department of Commerce, Washington, D. C., as Domestic Commerce Series No. 67. Size 6 x 9; 1070 pages. Obtainable from the Superintendent of Documents, Washington, D. C., for $1:00.

The Bureau of Foreign and Domestic Commerce undertook the compilation of this volume for the purpose of supplying statistical data to aid business in the analysis of consumer markets. Such analysis is for the purpose of enabling distributors to develop scientific systems of setting regional quotas, and adjusting their sales and promotional efforts to the probable market. The Bureau worked under the guidance of a committee composed of advertising and industrial executives. The factors used in each industry for measuring the relative importance of the manufacturing markets are:

1. Number of manufacturing plants.
2. Number of wage earners.
3. Number of salaried employees.
4. Wages paid.
5. Salaries paid.
6. Rated horse power of equipment in the plant.
7. Cost of materials.
8. Value added by manufacture.
9. Value of products.

Data on each of these factors by states, counties, major industry areas and principal cities are given.

A brief summary of the type of information abstracted and condensed from the Census of Manufactures is given below.

1. Major industrial areas.

2. General statistics of manufacturing industries (for the United States and also for special geographical areas).

3. Detailed statistics of manufacturing industries as a whole; also of specific industries for the United States as a whole and for special localities.

It would be easy to go on at length describing the contents of this book and praising it. It can be said in a word, however, that this work is the first comprehensive effort of its kind, and that it is an indispensable part of the library of every business man who has any connection with the sales department.

Journal of The Institute of Metals. Volume 48. ("Proceedings"). 350 pages. Cloth. Edited by G. Shaw Scott. Published by The Institute of Metals, 36 Victoria Street, Westminster, S.W.1, London, England. Price 31s. 6d.

The latest issue of the Journal of the Institute of Metals contains a record of the recent twenty-fourth annual general meeting of the Institute, and includes the inaugural address of the new President, Sir Henry Fowler, as well as fifteen papers of high scientific importance and the discussions that took place upon these papers. A novel feature of the present volume is the inclusion of a general discussion on "The Testing of Castings," opened by Dr. W. Rosenhain. The book concludes with a record of Professor F. Körber's May Lecture on "The Plastic Deformation of Metals."

Abstracts of these papers were published in METAL INDUSTRY for Apr l and May, 1932.

American Society for Testing Materials Publications. American Society for Testing Materials, 1315 Spruce St., Philadelph a, Pa.

"List of A.S.T.M. Standards and Tentative Standards." The final number in the serial designation denotes the year of adoption or latest revision of the specification. The price for separate copies of standards and tentative standards is 25 cents each. They are also available collectively through the Book of Standards and the Book of Tentative Standards at the prices indicated on the inside front cover.

"Refractories Manual." This publication brings together in convenient form the several A.S.T.M. standard specifications, methods of test and definitions pertaining to refractories. It also includes the latest revision of the Manual for Interpretation of Refractory Test Data.

Standard specifications are given for clay fire brick for (1) malleable furnaces; (2) stationary boiler service; and (3) marine boiler service. Methods of testing are given (1) for refractory brick; (2) for refractory materials under load at high temperatures; (3) for porosity and permanent volume changes in refractory materials; (4) for softening point of fire-clay brick; (5) for chemical analysis of refractory materials, including chrome ores and chrome brick. Also included are tentative test methods (1) for the resistance of fire-clay brick to thermal spalling and (2) for determining the particle size of ground refractory materials. Standard definitions include clay refractories; terms relating to refractories and to heat transmission of refractories.

The Refractories Manual comprises 93 pages; price 50 cents each.

Technical Papers

British Standard Copper Wire Specification. British Standard Specification No. 156-1932. Obtainable from the British Standards Institution, 28 Victoria Street, London, S. W. 1, England. Price 2s 2d.

British Standard Galvanizing Tests. British Standard Specification No. 443-1932. Obtainable from the British Standards Institution, 28 Victoria Street, London, S. W. 1, England. Price 2s 2d.

The Interference Method of Measuring Thermal Expansion. By George E. Merritt. Bureau of Standards. Research Paper No. 515. Obtainable from the Superintendent of Documents, Washington, D. C., 5 cents.

A Selected, Annotated Bibliography on the Hygienic Aspects of Aluminum and Aluminum Utensils. A Bulletin issued by the Mellon Institute of Industrial Research, Pittsburgh.

Among the conclusions arrived at are: (1) aluminum is not a poisonous metal and does not give rise to any disease; (2) aluminum utensils are very resistant to corrosion by foodstuffs cooked therein; (3) aluminum does not accelerate the destruction of vitamins or other food accessory substances during cooking.

A comprehensive bibliography of information on aluminum is also included in the bulletin.

Notes on Galvanic Corrosion. By Robert Worthington, International Nickel Company, New York. An explanation of the term galvanic corrosion and a description of the effect of sea water on various metals and alloys.

Shop Problems

This Department Will Answer Questions Relating to Shop Practice.

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Electroplating, Polishing, and Metal Finishing

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Free Cyanide in Silver Solutions

Q.—We are mailing under separate cover a sample of silver solution and silver strike solution for analysis. Solution plates very hard and porous. In making a brightener, we have used sulphuric Ether. Is this O. K.?

A.—Analysis of silver solution:

Metallic silver	2.25 ozs.
Free cyanide	1.87 ozs.
Analysis of silver strike:	
Metallic silver	.30 oz.
Free cyanide	1.11 ozs.

The metal content of both solutions is satisfactory, but the free cyanide content is too low in both solutions. Add to the silver solution 25 lbs. of sodium cyanide and to each gallon of the silver strike solution add 5 ozs. of sodium cyanide. The sulfuric ether that you are using is all right.

O. J. S., Problem 5,177.

Finishing Costs

Q.—In the manufacture of lighting fixtures, we find our finishing cost to be very high, to which we have not as yet found whether it is in equipment or inefficient help.

Through your experience, can you advise us as to what the approximate percent of the total cost of manufacture should be allowed for the finishing cost which involves both sprayed and plated finishes?

Also what average per cent can generally be allowed for the cost of finishing in the manufacture of ornamental bronze work?

A.—It is impossible to give exact information on your problem, as too many factors are involved. The finishing costs, would probably be somewhat more than half the total of the manufacturing costs, but each different type of work is a separate problem.

O. J. S., Problem 5,178.

Removing Burrs from Aluminum

Q.—I will appreciate any information you can give me on the two following questions. I am sending you a sample made of aluminum. This is to be used for ladies' shoehorns.

The trouble I am up against is how to remove burrs and sharp edges from these, and bring back a high finish. They are rolled in sand to remove the burrs and then burnished in a tumbling barrel using steel burnishing balls.

I am unable to produce the finish desired owing to the oxide that forms on the aluminum. The sharp edges reappear after a short time in rolling. I have used many dips, including gasoline, a light potash and nitric acid.

I have used leather and Vienna lime. We don't want to go to the expense of buffing.

A.—It is quite a difficult job to remove the sharp edges or burrs on the aluminum samples submitted, by the rolling or tumbling method. Believe that these burrs may be eliminated by the use of

USE THIS BLANK FOR SOLUTION ANALYSIS INFORMATION

Fill in all blanks if possible.

Date .....

Name and address: .....**Employed by:** .....

Kind of solution: .....**Volume used:** .....

Tank length: .....**width:** .....**Solution depth:** .....

Anode surface, sq. ft.: ..... **Cathode surface, sq. ft.:** .....

Distance between anode and cathode: .....**Kind of anodes:** .....

Class of work being plated: .....**Original formula of solution:** .....

REMARKS: Describe trouble completely. Give cleaning methods employed. Send small sample of work showing defect if possible. Use separate sheet if necessary. _____

NOTE: Before taking sample of solution, bring it to proper operating level with water; stir thoroughly; take sample in 2 or 3 oz. clean bottle; label bottle with name of solution and name of sender. PACK IT PROPERLY and mail to METAL INDUSTRY, 116 John Street, New York City.

a properly made blanking die and your tool maker should know how to overcome this trouble.

For a black on brass, the copper carbonate and ammonia is very good. For a black on copper use either sodium or potassium sulfide and scratch brush dry to get a good black color.—O. J. S., Problem 5,179.

Salt Water Gold on Pencils

Q.—Enclosed, please find sample bridge pencil, also brass parts we are attempting to gold flash in a small barrel. It seems impossible to get a uniform flash in a barrel because the ferrules do not stay in a mass, due to floating. Therefore we are having to put on quite a heavy (expensive) plate and then the uniformity is not dependable. The points plate more or less uniformly, but do not flash uniformly. We have come to the conclusion that the barrel is not the equipment suitable for flashing our particular parts.

Would an immersion dip be more practical for said parts than plating? If so, is it advisable to nickel plate the parts before gilding? What is the durability of gilding as compared with flashing electrolytically; also what equipment and solution would you advise for an immersion dip?

Enclosed also find two 10c pencils (not made by us) that have gold colored parts. What method do these manufacturers use to obtain a gold covering and yet retail the pencil for a dime? We want to know the least expensive method for coloring the parts of our pencil, yet we want to make a fairly decent job with some durability. Please give us detail procedure of the inexpensive method.

A.—It is quite a difficult task to explain to one who has had no experience with gold plating the complete method to use to produce a satisfactory finish. What we believe you need is the service of some good gold plater to install the plant for you. We are pleased to give you the method that you should use but what results you will have we do not know. Practical experience is necessary for good results.

For work such as yours we would recommend the use of a salt water gold solution. The salt water outfit can be purchased from several good supply houses, or it may be made by one who is familiar with this equipment. It consists of a tank to hold the salt water solution, a porous pot for the gold solution, and a cylinder of zinc.

The formula for the salt water gold solution is as follows:

Yellow prussiate of potash	16 oz.
Sodium phosphate	8 oz.
Sodium carbonate	4 oz.
Sodium sulfite	2 oz.
Gold as fulminate	3 pwt.
Water	1 gallon

The solution should be boiled for an hour or so before using. It cannot be boiled in the porous pot. An enameled pail or pan should be used.

This type of solution is usually used without any outside current as there is an electrolytic action which takes place from the action of the salt water on the zinc cylinder, which supplies enough energy to deposit the gold. With your type of work which is to be done in baskets and upon which a fairly good deposit is desired, we would recommend the use of an outside current. This is supplied by the generator and the positive lead is connected to the zinc cylinder and the negative lead from the generator is connected to the work. From 4 to 6 volts are used.

To produce a finish which will wear fairly well and to save the gold, the work should be nickel plated before it is gold plated. The cost of the gold on the samples submitted, for a deposit that would stand the acid test, would be approximately 25 cents a gross for the large parts and from 5 to 8 cents a gross for the other parts.—O. J. S., Problem 5,180.

Send a Sample!

Q.—We are interested in the best method of obtaining a dark and also a light statuary bronze finish, free from streaks, spotting and uneven color. The finish desired is smooth and shows no evidence of these objectionable defects.

The fixtures are in sections, each section being 17 feet long 24 inches wide and made of extruded naval bronze moulding.

We would also be pleased to be advised as to the size of tanks required if necessary and the kind of material from which they are constructed and number of tanks necessary; also the composition of the solutions and whether used hot or cold, manner of application, etc.

A.—It is quite difficult for us to tell you the exact procedure to use to produce a light and a dark statuary bronze finish to your work without seeing a sample of the finish desired. It may be necessary to copper plate the bronze, and then it may not, depending upon the shade of color desired, and it may be necessary to polish the work before finishing if a very smooth finish is wanted.

If you will send us a sample of the light and the dark color desired, and also a sample of the bronze metal to be finished, we will be pleased to give you the necessary information.

O. J. S., Problem 5,181.

Soft Nickel

Q.—We have a commercial job shop, and we have a chrome tank and we are thinking of discarding our present nickel solution, due to trouble. We want a nickel formula that chromium will take the best over. Attached is a blank properly filled out for analysis on the nickel solution.

A.—Analysis of Nickel Solution:

Metallic Nickel	2.15 oz.
Chlorides	1.20 oz.
pH	6.0

The metal and the chloride contents are too low and the pH is somewhat too high. We would suggest that you add to the solution 75 lbs. of single nickel salts, 35 lbs. of sodium chloride (common table salt), 6 fluid oz. of sulphuric acid, and one half gallon of 100 volume hydrogen peroxide. After making these additions stir solution thoroughly and let stand over night before using.

It will not be necessary to make a new solution if these corrections are made accordingly.

O. J. S., Problem 5,182.

Weak Brass Solution

Q.—A brass solution was made by us on Feb. 10, 1932.

Sodium cyanide	8 oz. per gal.
Copper cyanide	5 oz. per gal.
Zinc cyanide	1 oz. per gal.
Carbonate of soda	3 oz. per gal.
Ammonium chloride	1 oz. per gal.
Caustic soda	1 lb. per 100 gal.

We estimate this tank at about 375 gal. Our cathode surface is very irregular, andirons, fire sets, and fire screens being plated in this solution. This solution worked well giving us a good deposit in 15 minutes until around Oct. 1, 1932, when it became slow and the deposit got a dingy look. It is not as heavy plate as is required to buff out.

Additions of the above formula have been made to this solution from time to time, and with each addition the solution worked as well as new until around Oct. 1.

Our method of cleaning is:

Fire screens are first cleaned in a commercial cleaner bath to remove grease; then pickled in sulphuric acid bath; then boiled in water with about one oz. sal. soda per gal.; scratch brushed; dipped in pickle of hydrofluoric acid, about 1 gal. to 10 gal. of water; rinsed in cold water; then to plating solution.

The plating solution was operated with 6 volts and no rheostat on the line. Amperage runs from 300 to 700, according to load in tank.

A.—Analysis of brass solution:

Metallic copper	2.07 ozs.
Metallic zinc	.91 oz.
Free Cyanide	1.40 ozs.

The copper and free cyanide contents are too low. To correct this it will be necessary to add to the solution 20 lbs. of copper cyanide and 35 lbs. of sodium cyanide. Dissolve the copper cyanide and the sodium cyanide in water before adding to solution.

Operate the solution at 80° F. and if color is too red, add 1 pint of 26° ammonia to the solution.

O. J. S., Problem 5,183.

Patents

A Review of Current Patents of Interest

Printed copies of patents can be obtained for 10 cents each from the Commissioner of Patents, Washington, D. C.

1,893,424. January 3, 1933. **Buffing Machine.** Rudolph Luzardo, New York, N. Y.

1,893,443. January 3, 1933. **Apparatus for Machining Propeller Blades and Like Articles.** Llewellyn Thomas Pearce, Bristol, England, assignor to The Bristol Aeroplane Company, Limited, Bristol, England.

1,893,495. January 10, 1933. **Process for Making Coating Materials for Deoxidation of Rust.** Rudolf Eberhard, Munich, Germany.

1,893,499. January 10, 1933. **Process of Treating Metals.** William R. Jeavons, Cleveland Heights, and Mahlon J. Rentschler, Willoughby, Ohio.

1,893,611. January 10, 1933. **Wrinkled Finish Coating.** Theodore F. Bradley, Westfield, N. J., assignor to American Cyanamid Company, New York, N. Y.

1,893,761. January 10, 1933. **Manufacture of Chromium Oxide and Chromium Hydroxide.** Rudolph Caspar, Uerdingen-Niederrhein, Germany, assignor, by mesne assignments, to General Aniline Works, Inc., New York, N. Y.

1,893,821. January 10, 1933. **Method of Improving the Resistance of Alloy Articles to Corrosion.** Colin G. Fink, New York, N. Y., assignor to Allegheny Steel Company, Brackenridge, Pa.

1,893,984. January 10, 1933. **Alloy.** Michael G. Corson, Jackson Heights, N. Y., assignor to Electro Metallurgical Company, a Corporation of West Virginia.

1,893,992. January 10, 1933. **Production of Metals and Alloys by Reduction.** Walter Birkett Hamilton, Birkdale, and Thomas Allen Evans, Whitefield, England, assignors to Electro Metallurgical Company, New York, N. Y.

1,894,232. January 10, 1933. **Apparatus for Reducing Metal Stock.** George B. Coe, Waterbury, Conn., assignor, by mesne assignments, to Tube Reducing Corporation, Wilmington, Del.

1,894,324. January 17, 1933. **Apparatus for Forming Molds.** John E. Radigan, Detroit, Mich., assignor to Bohn Aluminum & Brass Corporation, Detroit, Mich.

1,894,558. January 17, 1933. **Method of Babbitting Double Connecting Rods.** William J. Fiegel, Detroit, Mich., assignor to Bohn Aluminum & Brass Corporation, Detroit, Mich.

1,894,609. January 17, 1933. **Plating Barrel.** Theodore M. Hiester, Dayton, Ohio, assignor, by mesne assignments, to Aero Supply Manufacturing Corporation, Corry, Pa.

1,894,657. January 17, 1933. **Method and Apparatus for Refining Metals.** Thaddeus F. Baily, Alliance, Ohio.

1,894,669. January 17, 1933. **Method of Electroplating and Compositions for Use Therein.** Frederick Conlin, New York, N. Y.

1,894,670. January 17, 1933. **Method of Electrocleaning.** Frederick Conlin, New York, N. Y.

1,894,807. January 17, 1933. **Polisher.** Henry E. Wiedmann, San Francisco, Calif.

1,894,812. January 17, 1933. **Battery Plate Filling Machine.** William O. Wuest, Van Nuys, Calif.

1,894,909. January 17, 1933. **Expansible Wheel.** James M. Mason, Philadelphia, Pa.

1,894,983. January 24, 1933. **Apparatus for Casting Core Molds.** William F. Eppensteiner, Rahway, N. J., assignor to The American Metal Company, (Limited), New York, N. Y.

1,894,982. January 24, 1933. **Method for Casting Copper or Equivalent Metals.** William F. Eppensteiner, Rahway, N. J., assignor to The American Metal Company, Limited, New York, N. Y.

1,895,078. January 24, 1933. **Multiple Spindle Lathe.** Arthur J. Lewis, Stratford, Conn., assignor to The Baird Machine Company, Stratford, Conn.

1,895,079. January 24, 1933. **Work Spindle Drive for Chucking Machines.** Arthur J. Lewis, Stratford, Conn., assignor to The Baird Machine Company, Bridgeport, Conn.

1,895,175. January 24, 1933. **Protective Coating and Method of Producing the Same.** John A. Staples, Plainfield, N. J., assignor to National Electric Products Corporation, New York, N. Y.

1,895,176. January 24, 1933. **Protective Coating and Method of Producing the Same.** John A. Staple, Plainfield, N. J., assignor to National Electric Products Corporation, New York, N. Y.

1,895,261. January 24, 1933. **Metal Alloy.** Harry K. Herschman, Washington, D. C., and John L. Basil, Annapolis, Md.

1,895,320. January 24, 1933. **Material for and Process of Coating Metal.** James H. Gravell, Elkins Park, Pa., assignor to American Chemical Paint Company, Ambler, Pa.

1,895,419. January 24, 1933. **Method of Making Decorated Drawn Metal Articles.** John S. Mitchell and Harry C. Rathke, Chicago, Ill., assignors to The Meyercord Company, a Corporation of Illinois.

1,895,421. January 24, 1933. **Electric Induction Furnace.** Edwin Fitch Northrup, Princeton, N. J., assignor to Ajax Electrothermic Corporation, Ajax Park, N. J., a Corporation of New Jersey.

1,895,532. January 31, 1933. **Buffer.** Sven Bäckström, Helsingfors, Finland.

1,895,533. January 31, 1933. **Composite Metal Article and Method of Making Same.** Glen D. Bagley, Great Neck, N. Y., assignor to Electro Metallurgical Company.

1,895,568. January 31, 1933. **Rust Proofing Iron and Steel Articles.** Leo P. Curtin, Cranbury, N. J., and Bernard L. Kline, Brooklyn, N. Y., assignors to The Western Union Telegraph Company, New York, N. Y.

1,895,569. January 31, 1933. **Production of Protective Coatings on Iron and Steel Articles.** Leo P. Curtin, Cranbury, N. J., and Bernard L. Kline, Brooklyn, N. Y.

1,895,596. January 31, 1933. **Automatic Die-Casting Apparatus.** Karl Friedrich Wagner, Stuttgart, Germany, assignor by mesne assignments, to Magnesium Development Corporation, Newark, N. J.

1,895,607. January 31, 1933. **Rolling Mill.** James R. Coe, Waterbury, Conn., assignor to The American Brass Company, Waterbury, Conn.

1,895,622. January 31, 1933. **Electroprocessing Machine.** Albert H. Hannon, Springfield, Ohio.

1,895,639. January 31, 1933. **Process of Producing Castings of Magnesium and High Grade Magnesium Alloys.** Albert Levy Mond, London, England, assignor, by mesne assignments, to Magnesium Development Corporation, a Corporation of Delaware.

1,895,643. January 31, 1933. **Method of and Apparatus for Measuring the Thickness of Metal.** Joseph F. Putnam, Berkeley, Calif., assignor to Standard Oil Company of California, San Francisco, Calif.

1,895,675. January 31, 1933. **Electrodeposition of Metals.** Frank C. Mathers, Bloomington, Ind., and Louis Bateman, East Lansing, Mich., assignors to United States Smelting, Refining & Mining Company, Portland, Me.

1,895,872. January 31, 1933. **Polishing Composition.** Frank R. Williams, Philadelphia, Pa.

1,896,003. January 31, 1933. **Gold Alloy.** Louis Lenfant, Paris, France, assignor to Cartier, Societe Anonyme, Paris, France, a Company of France.

1,896,022. January 31, 1933. **Plated Metal Body and Method of Producing Same.** Emil Theisz, Budapest, Hungary, assignor to Egyesült Izzólámpa és Villamossagi részvénytársasáy, Uj-Pest, Hungary.

1,896,045. January 31, 1933. **Method of Casting Magnesium and Alloys Thereof.** John A. Gann and James B. Reid, Midland, Mich., assignors to The Dow Chemical Company, Midland, Mich.

Equipment

New and Useful Devices, Metals, Machinery and Supplies

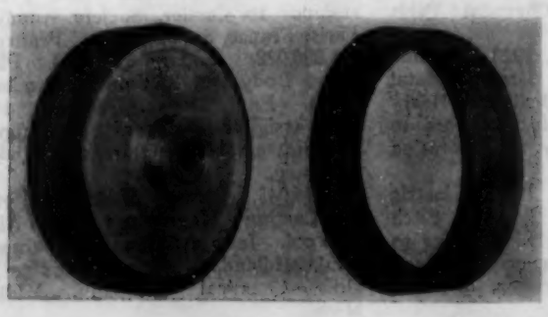
Expanding Polishing Wheel

The Joseph L. Howland Expanding Polishing wheel has been placed on the market by the Jiffy Polishing Wheel Company, 327 Frankfort Avenue, Cleveland, Ohio. This wheel consists of two flanges with beveled peripheries, and a heat proof rubber cushion, with the same degree of taper on inside as on the face of metal flanges. The inner flange is permanently fastened or mounted on shaft of polishing machine. Then an abrasive band of any grit desired is mounted on rubber cushion. Then the rubber cushion is placed on or over inner flange evenly; then outer flange is placed on shaft and drawn up as desired to make abrasive band tight. If abrasive band needs tightening on rubber cushion, simply take up the band by turning adjustable collar on outer flange, and this causes expansion of rubber cushion, and thus tightens abrasive band. Wheel should not be fully tightened up with adjustment collar when starting. It need only be taken up if abrasive band is too loose.

Cushions or rubber filler bands can be had in either hard, semihard or soft rubber depending on what kind of work is being done. Abrasive belts of any grit can be used, and can be applied in less than a minute. Aloxite cloth belts made by any abrasive manufacturer can be used, and can be had from mill supply houses, jobbers or direct from the abrasive manufacturer.

The wheel is said to have a perfectly flat surface, be absolutely balanced and run true at all times. Wheels are made in standard sizes, and in widths from 2" to 4" face. They do not change in diameter after use as with the old style built up wheel, and the old style grit and glue pot is eliminated. For example a 12" wheel is 12" at all times, and the speed of polishing machine need not be changed, as with built up wheels when they wear down.

The Jiffy expanding polishing wheel has no lap or break in the entire circumference. A special heat resisting rubber cushion outer band receives the abrasive belt, and is easily applied in less than a minute. Special expansion control applies uniform tension on abrasive belts over the entire surface. Wheels are available in standard diameters. It is claimed that no body pressure is required in polishing when Jiffy wheels are used. It requires only wrist movement on part of operator.



Expanding Polishing Wheel

Rubber Lining for Tanks and Drums

Acids of strongly oxidizing character such as chromic and nitric have always been considered beyond the range of corrosive materials which could be satisfactorily handled in rubber-lined tanks.

An exclusive new development of The B. F. Goodrich Rubber Company, Akron, Ohio, in which rubber-lined tanks are incorporated now widens the scope of application to include these extremely powerful oxidizing acids. Most important applications of this new development will be in chrome plating. In combination with hydrochloric, nitric acid is used as a pickling or cleaning bath for stainless steels, Monel metal and other alloys containing chromium, nickel or copper. Chief use for chromic acid is in electroplating.

The rubber lined drum eventually will replace carboys as shipping containers for muriatic acid, declares a bulletin just issued by The B. F. Goodrich Rubber Company, Akron, Ohio. Four reasons given are: lower freight rate; lower freight weight; ease of handling and no breakage; less storage space required.

New Solders

The Ruby Chemical Company, Columbus, Ohio, who for the past 25 years have been manufacturing a soldering flux known as "Rubyfluid," announces two new products —Acid Core Solder and Soldering Paste. Both are made from "Rubyfluid" flux, and claimed to be of unusually high quality. The manufacturers offer to send free samples to anyone interested who writes in on company letterhead.

Latest Products

Each month the new products or services announced by companies in the metal and finishing equipment, supply and allied lines will be given brief mention here. More extended notices may appear later on any or all of these. In the meantime, complete data can be obtained from the companies mentioned.

Fireproof Aluminum Paint, called Stixeat. Turnbridge Manufacturing and Supply Company, 52a-62a Longley Road, Tooting, London, S. W.17, England.

Self-Excited, self-synchronizing, self-contained, general purpose, synchronous motor. Ideal Electric Company, Mansfield, Ohio. Described in full in their Bulletin No. 540.

Rust-Preventive Lead Alloy Paint, called **Nust.** Manufactured by the Nor-Rust Liquid Lead Company of London, England. Information can be obtained from the American Consultants of this company, Lucius Pitkin, Inc., 47 Fulton Street, New York.

Fire Brick. Nonspalling, slag-resisting, non-shrinking and highly refractory. Laclede-Christy Clay Products Company, St. Louis, Mo. The brick is described in their bulletins on Mullite.

Super-Refractory. Highly Aluminous, insulating brick, to stand 2600 to 2700 degrees F. Made by Corundite Refractories, Inc., Massillon, Ohio. Described in their bulletin No. 10.

Swaging Machine for Pointing Rods. Made by the Langlier Manufacturing Company, Providence, R. I. The machine is used for pointing copper and nickel silver rods, preparatory to a drawing operation.

Kerosene Torch. For heating tar, pitch, etc., and for pre-heating. Also air-gas torches for soldering, tempering, etc. Torit Manufacturing Company, St. Paul, Minn.

Tubular Flow-Over Doors. Said to be as light as wooden doors of the same size. Cornell Iron Works, Long Island City, N. Y.

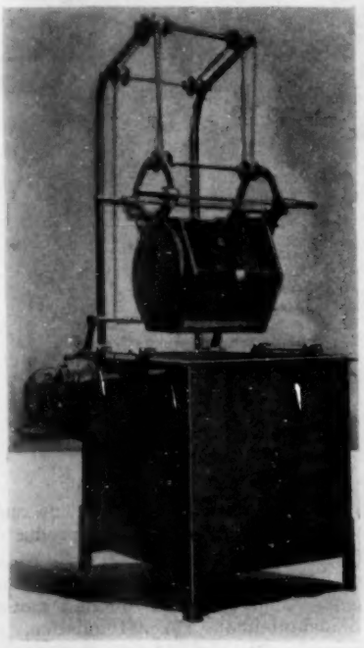
Potassium Silicate for Welding Flux

The Grasselli Chemical Company, Cleveland, Ohio, is placing on the market a new chemical product—potassium silicate.

One of the main uses for potassium silicate will be of interest. It has been found that potassium silicate is less hygroscopic and less affected by moist CO_2-laden air than is sodium silicate and is, therefore, more **desirable in fluxes for welding rods and for use in silicate paints.** Nearly all the welding rod manufacturers are showing decided interest in potassium silicate.

Small Sized Plating Machine

A new type of plating machine has been placed on the market by the Udylite Process Company, Detroit, Mich. This machine is called the "Maximus, Jr." It is compact, and is said to have a wide range of adaptability. Its construction eliminates the need for hanging auxiliary barrels on steel tank cathode rods. The barrel is driven by a belt or motor; the tank, 28 inches long, 21 inches wide and 22 inches deep. The entire machine weighs about 180 pounds.



"Maximus, Jr." Plater

Synthetic Veneer Provides New Type Metal Coating

Di-Noc Manufacturing Company, 863 East 140th Street, Cleveland, Ohio, has developed a new type of coating which can be applied to metals as well as other substances such as wood, paper, fibre board, etc. It is called Synthex Veneer, and is a resinous synthetic having very remarkable properties, according to the company. It is stated that sheet metals with the coating applied to them can be stamped, formed, spun or otherwise shaped without injury to the coating. Thus, sheets or blanks are coated while flat, and formed afterward. The Synthex is said to provide lubrication for dies, and thus eliminate the usual die lubricants, and to prevent die scratches which must afterward be removed.

The company states the material has already been applied to interior parts of automobiles very successfully. Tests have shown it to have very high resistance to corrosion, high and low temperatures, sunlight, etc. Applications of Synthex Veneer are possible by arrangement with the company, which will process sheets or blanks at its plant and deliver to the user for further forming, or it will make up complete products having the coating on them.

A feature of this material, according to the company's description, is its adaptability to reproduction of the appearance of other substances, such as grained wood, marble of several colors, or practically any appearance which can be photographed.

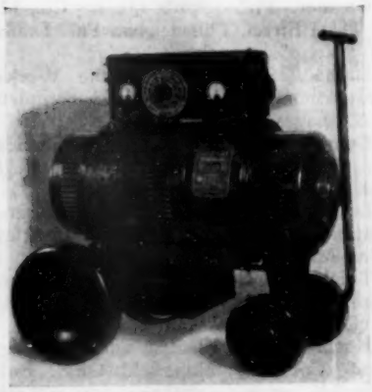
An experimental laboratory is maintained where special applications are worked out for prospective users.

Increased Capacity for Welders

Under the slogan, "Count the Kilowatts," Hobart Brothers, Troy, Ohio, are announcing that all 1933 models in their line of arc welders will be available on the same increased capacity rating basis used in connection with their 400 ampere model for the past year and a half.

In addition to more powerful motors to guarantee the 60 per cent increase in welding capacity, the new models are provided with new drip-proof housings with 3-point louvre ventilation. In addition to thorough protection with exceptionally cool operation, the new design is said to be very much improved in appearance, symmetrical and well balanced.

Other features are reverse polarity switch with double scale meters, selective reactance, and remote control.



New Hobart Welder

Exceptionally high efficiency, power factor and wide welding range are claimed for the new line, as well as uniform welding current, quick arc recovery, great arc tenacity, and freedom from sticking and splattering.

The new models are available in capacities ranging from 5 KW (125 amps. at 40 volts) to 24 KW (600 amps. at 40 volts), with electric motor or gasoline engine drive, as well as for pulley or coupling drive.

COPPER—Elliott Harrington of General Electric Company told the Franklin Institute last month that air conditioning will be widespread, and will be installed even in small homes. (Air conditioning requires equipment made to a large extent of copper and other metals.)

Solders, Babbitt and Lead

Glaser Lead Company, Inc., 31 Wyckoff Avenue, Brooklyn, N. Y., manufactures a wide variety of lead products, lead-base alloys, and offers alloys made to specification. The company's major field is in lead and tin mixtures, and it specializes in solders, babbitts and white metals for casting purposes. The line includes pig lead and tin, lead pipe, traps, sheet, bars, bends, wool, etc., antimonial lead, slush metal, bar tin, and acid and rosin core solders. Another line this company offers is chemical lead sink plug assemblies for technical and laboratory use; and lead roof flashing and waterproofing caps.

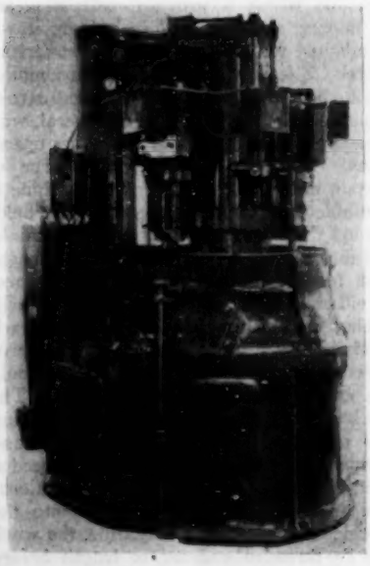
Special products in lead-base and tin-base metals are produced to order.

Baird Automatic Multiple Spindle Grinder

A machine just developed that should be of interest to those having internal grinding on a large quantity basis is the Baird Multiple Spindle Grinder here shown.

This particular one has eight spindles. There are six grinding stations and also two stations that may both be used as loading and unloading stations, or one may be for such purpose and the other arranged as a polishing or gauging or testing station. In this machine the wheels do not have to be the same size nor are they dressed alike. Each wheel is automatically dressed and sized according to its need and independently of any other wheel. The speed and feed of each wheel is independent of any other wheel. Also any grinding wheel may be replaced at any point in the cycle without disturbing any other wheel.

Roughing and finishing wheels may be used. Different diameters of holes may be ground at one set up of the machine. Machine may be arranged to operate double indexing so that a piece of work may be first ground from one end and at the second pass through the machine be ground from the other end, or two pieces of work may



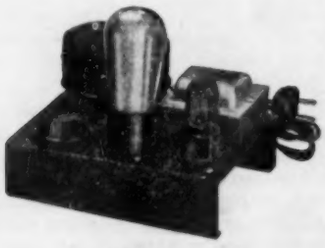
Baird Automatic Multiple Grinder

be unloaded and loaded at each cycle of operations.

The machine takes a floor space of about 74" x 71" and stands about 106" high. It weighs about 27,000 lbs., requires about 20 horsepower for the machine and 2 to 3 horsepower for each wheel, depending on the job. Totally enclosed mechanism, anti-friction bearings, automatic lubrication, and automatic safety controls are provided. The capacity is for work up to 11" diameter. A copious flow of coolant carries away the heat and also the chips.

Photoelectric Control

A new, low-cost photoelectric relay, the "Foto-Switch," is announced by G-M Laboratories, Inc., 1735 Belmont Avenue, Chicago, Ill. This unit embodies an electro-magnetic switch which is opened or closed by the interruption or variation in illumination on the photoelectric cell. With the "Foto-Switch," any sort of electrical device, such as motors, electric signs, signals, or alarms can be controlled through the medium of a light beam.



"Foto-Switch"

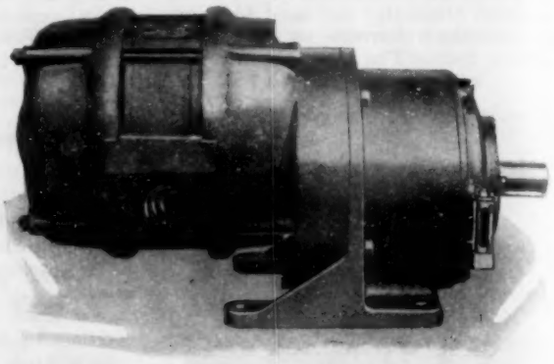
Full information on the "Foto-Switch" and available accessories can be obtained by readers from G-M Laboratories, Inc.

Automatic Electric Header with Heating Device

National Machinery Company, Tiffin, Ohio, makes an automatic electric heading machine which is provided with a means of heating the stock before heading it. It is adapted for either ferrous or nonferrous metal. The machine is said to accomplish a number of jobs in one heading stroke which previously were done in several, with anneals between the several heading operations. This has been especially true of certain nonferrous metals. The machine is manufactured under license from the holders of the Kobert patents. Stock can be fed into the machine from a coil, or magazine feed of cut lengths can be arranged. In either case, it operates continuously, producing a finished headed piece at each stroke. The heating is done by three progressive stages of low-voltage current, only the end to be headed being heated. The work is thus produced with heads having the properties of hot-headed work and shanks with the bright finish of cold-headed solid-die work, according to the National company. When blanks are fed into the machine by means of a magazine, the work can be threaded and cut to length before it is headed.

Geared Motors

Ideal Electric and Manufacturing Company, Mansfield, Ohio, offers geared motors with gear reduction units integrally built in. No motor coupling is used, high speed gear being mounted directly on motor shaft. Units are available in all gear ratios from 2.09 to 1 up to 376 to 1, giving output speeds from 861 r.p.m. to 4.7 r.p.m., using standard 1800 r.p.m. motor supplied with unit. Motors are supplied in sizes from ¾ to 20 horsepower, open or enclosed types, 2 or 3 phase A.C., or D.C., and variable speed types. The illustration shows a heliocentric geared motor unit.



"Ideal" Geared Motor

Equipment and Supply Catalogs

Available free on application to the manufacturers mentioned, unless otherwise stated. Please mention this notice.

Cleaner. Philadelphia Quartz Co., 121 S. Third Street, Philadelphia, Pa. Leaflet on "Metso" crystals.

Lathes. South Bend Lathe Works, South Bend, Ind. Catalog 93, complete in 72 pages, illustrated.

Cement Cleaner. Magnus Chemical Co., 13 South Avenue, Garwood. N. J. Cleaner for cement floors.

Diaphragm Pump. T. Shriver and Company, Harrison, N. J. Booklet, "For Materials Hard to Pump."

Thickener Colloid. Kem Products Company, 227 High Street, Newark, N. J. Leaflet on "Kem No. 222."

Motors. Ideal Electric and Manufacturing Company, Mansfield, Ohio. Bulletin 540 on self synchronizing motors.

Iron and Steel Finish. Metal Oxidation Corp., 225 Fifth Ave., New York. New rustproofing and finishing process.

Grid Flooring. Truscon Steel Company, Youngstown, Ohio. Two new types; for open flooring and for concrete floors.

Employee Handbooks. Metropolitan Life Insurance Company, New York. Booklet on company handbooks for employees. Very interesting.

Thermometers. Bristol Company, Waterbury, Conn. Catalog 1204, Vapor Tension Type, Class II, for recording, controlling and indicating.

Temperature Regulators. Atlas Valve Company, 282 South Street, Newark, N. J. Data and prices on "Victor" vapor type regulators for liquids.

Foundry Equipment. The Macleod Company, Bogen Street, Cincinnati, Ohio. No. 101 A on labor savers for foundries and drop forging plants.

Furnaces. H. O. Swoboda, Inc., 3530 Forbes Street, Pittsburgh, Pa. Furnaces for hardening, tempering and annealing strip metal and wire products.

Variable Speed Motors. U. S. Electrical Manufacturing Company, Los Angeles, Calif. Bulletin on new motor with instantaneous speed regulation.

Corrosion Resisting Linings. Stebbins Engineering and Manufacturing Company, Ltd., Watertown, N. Y. Bulletin 1 on linings for industrial equipment.

Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa. Publications: Engineering Achievements—1932, and New Flexarc Welders.

Machine Tools. Monarch Machine Tool Company, Sidney, Ohio. Bulletin on patented centrode device, oval chuck, and Monarch-Keller form turning machines.

General Electric Company, Schenectady, N. Y. New publications: Squirrel-cage Motors; Synchronous Motors for Driving Metal-rolling Mills; Electric Gluepots.

Plating Solution Control. Electroplaters' Technical Institute, 619 Wellington Avenue, Chicago, Ill. Leaflet on outfits for chemical control of all types of solutions.

Industrial Standardization. American Standards Association, 29 West 39th Street, New York. February, 1933, issue of magazine contains data on various metal working and finishing subjects.

Modernization. General Electric Company, Schenectady, N. Y. A very fine booklet on plant modernization, giving considerable food for thought on the idea that "when you operate obsolete equipment, you pay for modernization without getting it."

Personals

Aldus C. Higgins Heads Norton Company

Aldus C. Higgins was elected president and general manager of the Norton Company, Worcester, Mass., at the company's annual meeting January 17, upon the retirement of Charles L. Allen, who has been the one and only general manager of that company for 47 years, and its president since 1919.

Although Mr. Allen has retired from executive participation in the affairs of the company, he was elected chairman of the board of directors and will still be in close touch with its business activities. Mr. Allen has been associated with the Norton Company since the incorporation of the old Norton Emery Wheel Company in 1885.

ALDUS C. HIGGINS

George N. Jeppson, vice-president in charge of production, was made treasurer to succeed Mr. Higgins. Other officers of the company are Clifford S. Anderson, general counsel and secretary; W. LaCoste Neilson, vice-president and general sales manager; Lewis E. Saunders, manager of research and abrasive plants; Henry Duckworth, assistant treasurer and comptroller, and Clarence W. Daniels, plants engineer.

Aldus C. Higgins is a son of one of the founders of Norton Company and its first president, Milton P. Higgins. He has been associated with the company since 1900, in the early years as manager of research laboratories, manager of research and abrasive plants; secretary from 1912 to 1919, and treasurer and general counsel from 1919 to 1933.

Mr. Higgins entered the employ of the Norton Company as a member of the research laboratories after having been graduated from Worcester Polytechnic Institute and the National Law School. He was subsequently appointed manager of research and abrasive plants. While serving in that capacity he developed an electric furnace for fusing abrasives for which he was awarded a John Scott Medal. He was elected secretary of the company in 1912. In 1919 he became treasurer, and general counsel of the concerns. He has held the office of treasurer until his elevation to the presidency of the concern, and the office of general counsel until a few years ago when Mr. Anderson was elected to that office.

Edward J. Cornish, president since 1916, has been elected chairman of the board of directors of National Lead Company, New York. F. M. Carter, for the past six years vice-president, has been elected president. Mr. Carter is a nephew of the founder of the Carter White Lead Company, which was acquired by National Lead in 1906. Mr. Cornish at that time was president of the Carter company.

Edward P. Connell, comptroller of the Falk Corporation, Milwaukee, Wis., has been made a vice-president. He has been with Falk since 1913.

John R. Hewett, editor of the "General Electric Review" for nearly 20 years, has been retired because of ill health. For more than a year he has been unable to carry on his active duties. Born in England, he received his degree in electrical engineering from Finsbury in 1902. As a special correspondent for the magazine, "Engineering," of London, he came to this country to attend the St. Louis Exposition in 1904. After the exposition he went with the General Electric Company, in the publicity and transportation departments, and in 1913 was made editor of the Review.

H. M. Gassman, 10th Avenue and 4th Street, N. W., Birmingham, Ala., sales representative for Coppus blowers and steam turbines in the Alabama territory, has been appointed sales representative in that district for Coppus-Annis dry type air filters, the latest addition to the line of the Coppus Engineering Corporation, Worcester, Mass.

Obituaries

Willard R. Carroll

Willard R. Carroll, rolling mill engineer of the Farrel-Birmingham Company, Inc., Ansonia, Conn., died at his home at New Haven, Conn., on February 3, 1933. He was born in Meriden, Conn., in 1872. His early education was obtained in the public schools of that city, following which he attended Sheffield Scientific School of Yale University.

Mr. Carroll was widely known throughout the brass and copper industry, where he had a reputation as an outstanding engineer. He developed the largest tube drawing machine ever built in the United States, and the first tube mill for nonferrous seamless tubing, and was responsible for numerous other developments and improvements in the design and operation of rolling mills.

In 1925 he joined the Farrel Foundry and Machine Company as a consulting engineer on the rolling mill work. During his service with that company and its successor, Farrel-Birmingham Company, Inc., he designed the first roller bearing copper rod mill, which is responsible for extraordinary economies in operation and increased output.

Prior to his connection with the Farrel company he conducted a consulting engineering business of his own, and at various times had been on the staffs of nonferrous metal producers and machinery builders as engineer, superintendent and works manager.

Mr. Carroll was highly esteemed for his personal qualities as well as for his professional ability by all of his associates and his many friends in the trade, and his passing is deeply regretted.

WILLARD R. CARROLL

He is survived by one daughter.

Charles Vickers

Charles Vickers, widely known consultant and writer on nonferrous metallurgy and foundry work, died January 19, 1933, at General Hospital, Buffalo, N. Y., after several months' illness. He was 67 years old.

Born in England, Charles Vickers entered the metal trade as a small boy and studied it hard for the rest of his life. He worked in a variety of plants and shops in England, and received the basis

for his later knowledge under real and often strenuous working conditions. He apprenticed himself to the foundry trade, became a journeyman founder with the firm of Clayton and Shuttleworth, Birmingham, England, then went to Ruston Proctor and Company, where he worked until he was twenty-three. Then he emigrated to America, and got his first job here as a molder with the Capitol Iron Works, Topeka, Kansas. He moved about considerably in the early days here, and worked for a number of foundries. By 1905 he had become foreman of the brass foundry of the Milwaukee Electric Railway and Light Company. While there he began writing articles for the technical press, and in 1910 he became associate editor of "The Foundry," of which he was nonferrous editor and member of the advisory staff at the time of his death. In 1913 he became metallurgist of the Titanium Alloy Manufacturing Company, Niagara Falls, N. Y., remaining there until 1917, when he resigned and set up his own consulting business in Buffalo.

Throughout his career Charles Vickers was constantly in search of facts regarding metals, both ferrous and nonferrous. He read, experimented and wrote about this field, and was one of the prominent foundry consultants of the United States. He wrote "Metals and Their Alloys," an authoritative treatise on the subject.

John F. Staab

Last month we made brief mention of the death on January 23, 1933, of John F. Staab, superintendent of the Edwardsville Brass Works of the N. O. Nelson Manufacturing Company, Edwardsville, Ill. He was 77 years old.

Mr. Staab was one of the oldest active brass men in the state of Illinois at the time of his death, and he had devoted 64 years to the industry. He was born at Williamsburg, Mass., in 1856, and learned the brass manufacturing business there. He moved to Edwardsville in 1902 to take charge of the brass works which is now owned by the Nelson company, a large manufacturer of plumbers' brass goods.

Mr. Staab is survived by two sons and several brothers.

W. R. Hill

W. R. Hill, widely known Central New York business man, president of Sargent and Greenleaf Company, Rochester, lock manufacturers, died February 6, 1933, aged 65.

Mr. Hill was born at New Brunswick, N. J., and was educated at Rutgers Preparatory School. He started in business with the Sargent Hardware Company, New Haven, Conn., later became head of Isko Company. In 1923 he became head of the Rochester firm. He was regarded as an authority on builders' hardware, a subject on which he had written extensively.

Warren D. Kent

Warren D. Kent, superintendent of the General Fire Extinguisher Company foundry, at Auburn, R. I., died at his home, 11 Fenner Street, Auburn, February 4, in his 64th year. He had been ill since September. He was born in Providence and had been associated with the Extinguisher Company ever since he left school. He was a 32nd degree Mason and held membership in the Providence Engineering Society and the New England Foundry Association. He is survived by his widow, three daughters and one son. —W. H. M.

Benjamin B. Thayer

Benjamin Bowditch Thayer, vice-president of the Anaconda Copper Mining Company, New York, died at the age of seventy on February 22, 1933, just eleven days after the death of John D. Ryan, Anaconda board chairman, whose obituary is also on this page.

Mr. Thayer was born at San Francisco, Calif., in 1862, and was educated first there then at Harvard. He became a civil engineer in 1885, and entered the mining industry at once. In 1889 he became a mine foreman for the Anaconda at Butte, Mont., and after six years there he went to the Hearst interests for whom he managed mining properties. Then he went to the Amalgamated Copper Company, of which he became president in 1908. When it was merged with Anaconda, he became vice-president of the consolidation. He also held high positions with Raritan Copper Works, Anaconda Sales Company, Electrolytic Zinc Process Company and Santiago Mining Company. He was active and widely known in American engineering circles.

Mr. Thayer is survived by his widow, three married daughters and several grandchildren.

Ramon P. Lopez

Ramon P. Lopez, a former national vice-president of the American Electroplaters' Society, died at Rochester, N. Y., recently of intestinal cancer. Mr. Lopez was a well known Rochester electroplater. He took an active interest in the Rochester Branch of the A. E. S., and also in the Society's national affairs, and was well known and widely admired in the industry.

Charles A. Young

Charles A. Young, president of Young Brothers Company, Detroit, Mich., manufacturers of industrial ovens, and formerly superintendent of the Detroit Sheet Metal and Brass Company, died February 17, 1933, at the age of 74. He was a native of Windsor, Ont., and came to Detroit when he was 24.

Walter King

Walter King, superintendent of the enameling plant of the Pfaudler Company, Elyria, Ohio, died December 8, 1932, of pneumonia. Mr. King was 37, and had been with Pfaudler since 1917, starting as laboratory assistant.

Walter S. Killam

Walter S. Killam, general manager of the Capitol Brass Company, a division of Bohn Aluminum and Brass Corporation, Detroit, Mich., died recently, aged 56.

John D. Ryan

John D. Ryan, chairman of the board of directors of the Anaconda Copper Mining Company, New York, died February 11, 1933. He was 69 years old, and one of the most important industrial executives in the country. While his chief interest was copper mining, he was also a great brass man, through Anaconda's ownership of American Brass Company, Waterbury, Conn., of which Mr. Ryan was a director.

John D. Ryan was born at Hancock, Mich., October 10, 1864. His father was a copper mining man, but the son was disinclined at first to enter that field, nor did he go to college as his father desired. He turned to business as a young man, selling lubricants over a territory stretching from Montana to Mexico. While still young he fell in with Marcus Daly, the pioneer who laid the foundations for the Anaconda Copper structure. Daly offered Ryan a job at the time, but the latter declined. Some time later, Ryan acquired an interest in some of Daly's financial institutions, and after some time he emerged as the direction force of the Daly organization in Montana. He progressed rapidly in the financial and mining worlds, and while still a young man entered the celebrated struggle for dominion over the Montana copper empire, which was then split up between the H. H. Rogers interests and those of Fritz A. Heize.

After the clash, in 1904, Mr. Ryan became managing director of Amalgamated Copper Company, which bought the Heize interests in 1906, and consolidated the Montana copper mining industry under the name of the Amalgamated, with Mr. Ryan as president. This finally became the Anaconda. Finally, to complete his copper interests, he took an interest in the largest wire and brass mills and fabricating plants, and eventually formed the American Brass Company, world's largest brass producer, as a subsidiary of Anaconda. Besides copper, Mr. Ryan also became a factor in the power and railroad industries. During the war he took charge of airplane construction for the American forces.

During his life John D. Ryan amassed one of the world's greatest fortunes. His rise from clerk in a general store to copper king is one of the romances of American industrial progress.

Everett I. Rogers

Everett I. Rogers, president of Parks Brothers and Rogers, Inc., jewelry manufacturers of Providence, R. I., and founder of the Manufacturers' Refining Company there, died February 3, 1933, at Miami, Fla. He was 73 and in poor health. Mr. Rogers was a widely known manufacturer, and had also taken a very active part in civic affairs in Rhode Island.

John M. Craig

John M. Craig, brass founder of 69 Arch Street, Philadelphia, Pa., died last month in his 74th year. Mr. Craig had conducted the foundry at Philadelphia for 28 years. He was a native of Quincy, Mass., and entered the brass industry as a young man at Springfield, Mass. In 1892 he went to Hartford, where he managed the brass

foundry of the Colt Patent Fire Arms Company until 1905, when he established his own business at Philadelphia.

Mr. Craig is survived by his widow, four daughters and several grandchildren.

Alfred J. Russell

Alfred J. Russell, president of Russell and Watson, Buffalo, N. Y., manufacturers of metal kitchen equipment, died February 1, 1933.

News of Associations

American Electroplaters' Society

The Annual Convention of the American Electro-Platers' Society, to be held at Chicago June 27-28-29-30, is going to be the one convention that you just cannot afford to miss. We have tried to tell you in previous articles something about Chicago's history, its transportation facilities, its industrial activities, its beautiful parks and boulevards, and now we will tell you something about why Chicagoans have the "I WILL" spirit and pep.

It's the climate. Chicago's summer weather is delightfully temperate, due in a large measure to the immense body of water at its gates, Lake Michigan., In summer it is a vast refrigeration plant that keeps the city cool. There are occasional hot days, of course, but the famous breezes of Chicago sweep over the cool green water, restoring the bracing quality to the air.

From May to October, often until Christmas, the climate of Chicago is notably fine. But in summer, particularly, the visitor appreciates the sparkling clear days that tempt to continued outdoor activity and the cool, sleep-inducing nights.

In all America, there is no large city where one may play and rest so comfortably during a summer vacation. You may have every reasonable expectation of bright, cool days when you visit us next June. The headquarters in the Congress Hotel on beautiful Michigan Avenue, facing Grant Park and Lake Michigan, assures you of the most beautiful location and comfort from the refreshing lake breezes.

Chicago's elevation averages 590 to 652 feet above sea level. Chicago is known as the healthiest large city on the Continent. Is it any wonder that Chicago is the natural convention center of the United States? It is also the nearest large city to the Center of Industry, the Center of Population, and the Center of Agriculture.

We are positive that no convention ever held by the American Electroplaters has offered as much as this one will. The Educational Committee has secured a large number of the most practical papers ever presented at an annual meeting. Let us also mention the beautiful and comfortable headquarters in the Congress Hotel, the finest transportation facilities; the Century of Progress Exposition, the greatest exposition ever held in history from an educational standpoint; an assurance of comfortable weather; and the Chicago Branch waiting and eager to entertain and serve you.

That's why we are constantly reiterating the phrase: **"You cannot afford to miss the 1933 A.E.S. Convention."**

CONVENTION COMMITTEE.

Newark Branch

Newark Branch, A. E. S., will hold its annual educational session and a dance on April 29, at the Elks' Club, Broad Street, Newark, N. J. Plant visits have been arranged. The technical session will begin at 2:30 p. m. Everyone interested in plating and finishing is urged to attend the session, and also the dance and entertainment in the evening. Ladies are invited.

Baltimore-Washington Branch

The annual dinner and educational session of the Baltimore-Washington Branch, A.E.S., was held at Baltimore on February 4. Despite particularly bad weather and the poor general conditions, 45 attended. During the dinner Thomas Slattery sang several solos, and other musical and dance numbers were rendered by some of the guests.

The session after the dinner was highly informative. The papers were:

Recent Developments in Electroplating, by George B. Hogaboom, Hanson-Van Winkle-Munning Company.

Progress Report on Exposure Tests of Plated Coatings, by Dr. William Blum, Bureau of Standards.

Progress Report of Accelerated Exposure Tests of Plated Coatings, by W. C. Strouser and A. Benner, Bureau of Standards.

IRVIN H. HAHN, Secretary.

Major Meetings in 1933

American Electroplaters' Society, Annual Convention, Congress Hotel, Chicago, Ill., June 27, 28, 29, 30.

American Foundrymen's Association, Annual Convention and Exposition, Stevens Hotel, Chicago, Ill., week of June 19.

The Electrochemical Society, Spring meeting, Hotel Windsor, Montreal, Canada, May 11, 12, 13; Fall meeting, Chicago, Ill., September 7, 8, 9.

American Society for Testing Materials, 1933 Meeting and Second Exhibit of Testing Apparatus, Stevens Hotel, Chicago, Ill., June 26, 27, 28, 29, 30.

Institute of Metals Division, A.I.M.E., Annual Meeting, Engineering Building, 29 West 39th Street, New York, February 20, 21, 22, 23.

National Metal Congress and Exposition, Detroit. W. H. Eisenman, Secretary, 7016 Euclid Avenue, Cleveland, Ohio, October 2-6.

Connecticut Nonferrous Foundrymen's Assn.

February meeting of Connecticut Nonferrous Foundrymen's Association was held at Hotel Garde, New Haven. After the usual dinner, O. G. Willey, metallurgist, Jenkins Brothers, Bridgeport, spoke on "Laboratory Control of the Foundry." There was enthusiastic response to the address. C. H. Blanchard of Reading, Pratt & Cady Co., Hartford, Conn., presided.

Next meeting will be held March 13 at Hotel Garde, New Haven, with dinner at 7 p.m. as usual. R. C. Miller, Osborn Mfg. Co., Cleveland, Ohio, will speak on "Molding Machine Problems." The following meeting will be at the same place on April 10, with W. M. Saunders of Providence, R. I., speaking on "Foundry Sands," through courtesy of Whitehead Brothers Company.

LOUIS G. TARANTINO.

American Society for Testing Materials

The following committees of the American Society for Testing Materials met in New York during the week of March 6, at which the work in the respective fields covered by the committees will be studied and discussed:

Subcommittee VII on Methods of Chemical Analysis, of Committee B-3 on Non-Ferrous Metals and Alloys.

Subcommittees VI on Atmospheric Corrosion. VII on Corrosion in Liquids, and VIII on Galvanic and Electrolytic Corrosion, of Committee B-3 on Corrosion of Non-Ferrous Metals and Alloys.

B-5 on Copper and Copper Alloys, Cast and Wrought.

B-7 on Light Metals and Alloys, Cast and Wrought.

Joint A.S.M.E.—A.S.T.M. Research Committees on Effect of Temperature on the Properties of Metals.

G-8 Sectional Committee on Zinc Coating of Iron and Steel.

American Zinc Institute

The American Zinc Institute, 60 East 42nd Street, New York, will hold its regular annual meeting of the membership on Tuesday, April 18, 1933, in New York City. Reports of officers will be submitted, and eight directors elected for a three-year term. The Board of Directors will then hold a meeting, at which officers of the Institute will be elected for the ensuing year.

New York Silver Manufacturers' Association

Abraham Cooperstein, of Elgin Silversmith Company, New York, was elected president of the New York Silver Manufacturers' Association, Inc., at a meeting on February 23. Other officers elected include Charles Marks, secretary, and Sam Rifkin, of Rifkin Brothers, New York, treasurer.

New England Jewelers and Silversmiths

The New England Manufacturing Jewelers' and Silversmiths' Association held its annual meeting last month. Following directors were elected for three years: From Providence, Alfred K. Potter of The Gorham Company; Ellis W. MacAllister of Irons & Russell Company; Frederick A. Ballou of B. A. Ballou & Co., Inc.; Archibald Silverman of Silverman Bros.; Royal J. Gregg of the Ostby & Barton Company. From Attleboro, Gustave W. Strandberg of Sykes & Strandberg; North Attleboro, Donald LeStage of the LeStage Manufacturing Company; and R. G. Scott of the Reed & Barton Corporation, Taunton. Horace M. Peck, secretary, reported membership of 327. During 1932 there were 1,415 business embarrassments reported in the jewelry industry, of which 104 were wholesalers, 990 retail and installment, 83 manufacturers and the balance miscellaneous. During the year the Board issued 29,233 reports from its credit reporting department, and handled 8,716 collection claims totalling $728,570. It also handled 5,243 failure claims aggregating $1,746,255.

W. H. M.

Industrial and Financial News

World Aluminum Output in 1932 Off 34% from 1931

World production of aluminum for 1932 is estimated at 152,795 metric tons by "The American Metal Market," New York. This represents a decrease of 34% from the 1931 production of 230,433 metric tons, it is stated. The estimate is based on information from reliable sources. The 1932 output was the lowest since 1923, when it was 139,100 metric tons. The paper mentioned gives the following comparative table of output by countries:

World Aluminum Production

(Estimated in metric tons of 2,204.6 pounds)

	1930	†1931	†1932
United States...	103,900	80,533	47,575
Canada	34,900	30,950	17,800
N. America.....	**138,800**	**111,483**	**65,375**
France	30,500	24,400	14,110
Switzerland	22,400	16,000	13,820
Germany	31,500	26,750	13,765
Austria-Hungary	1,200	3,000	3,200
England	19,900	15,000	8,825
Norway	20,500	21,300	19,500
Italy	8,200	11,500	13,200
Spain	1,000	1,000	1,000
Europe	**135,200**	**118,950**	**87,420**
Grand totals....	**274,000**	**230,433**	**152,795**

† Preliminary, subject to revision.

El Paso Replacing Iron Water Pipe with Copper

Approximately 5,500 iron water service pipes at El Paso, Texas, have been replaced with copper pipe. This is about a third of the city's 16,000 service pipes the municipality plans to replace while the copper price is advantageous. It is expected that the copper pipe will not need replacement for a century, whereas the iron pipe formerly used has had a life of 2 to 15 years, generally.

Russian Aluminum Works

Operations have been started at the Volkhov Aluminum Works in the U.S.S.R., according to reports received last month. Initial output rate is placed at 5,000 tons a year, which the Soviets plan to double next year. The Dnieper plant, which is almost finished, will have a capacity of 20,000 tons a year, it is stated.

Remington Arms Busy; Not Merging with Winchester

Remington Arms-Union Metallic Cartridge Company, Bridgeport, Conn., reports this year's was its busiest January in several years. Operations were increased to five days a week (previously three), and President Saunders Norvell stated that the prospects are good, attributing the improvement to increased sporting arms demand.

Reports that a merger was being planned involving Remington and the Winchester Arms Company were denied by Mr. Norvell.

Work Flies from Buff, Kills Plant Owner

Leonard W. Lees, 42, one of the owners of the Eastern Coupling Company, 9 Calender Street, Providence, R. I., was fatally injured while working at a buffing machine at the plant on February 4. The company manufactures heavy brass couplings, especially for fire and mill hose, and one of these couplings was being revolved at a high rate of speed in the buffing machine. In some unexplained manner the brass casting was released and struck Mr. Lees in the forehead with great force as he was leaning over the machine. He suffered a fractured skull and died at Rhode Island Hospital a few hours later.

R. & H. Chemicals

The R. & H. Chemicals Department of E. I. du Pont de Nemours & Company, Inc., Wilmington, Delaware, has opened a Charlotte, N. C., office at 300 West First Street, with R. M. Levy as manager. Mr. Levy was formerly in charge of The R. & H. Peroxygen Sales in the New York office. Assisting Mr. Levy on sales is LeRoy Kennette. J. C. Robertson and C. D. Potter, bleaching experts, have also been assigned to the Charlotte office to give prompt service to Southern customers.

The Cleveland, Ohio, district sales office of the R. & H. Chemicals Department has been removed from 607 Hanna Building to 1235-6 Guardian Building. Mr. Carl Dittmar is manager.

Parker Rust-Proof Company Increases Dividend

Parker-Rust-Proof Company, Detroit, Mich., paid a dividend of 62½ cents on common stock on February 20. This was 12½ cents more than the dividend paid three months previously. The increase was in conformity with the management's policy of paying dividends as earned, according to W. M. Cornelius, president, who said:

"This distribution is well within our last three months' earnings. Volume of shipments for November and December were in excess of any previous like two months. Due to additional new customers and wider use of new processes the company's 1933 prospects are satisfactory."

Much Aluminum Used in Seattle Federal Building

One of the unique features of the new $2,000,000 Federal office building at Seattle, Wash., and one that is distinctly a "new comer" to Northwest construction circles, is the large quantity of aluminum used for ornamentation. More than 21 tons of this material was used for the aluminum spandrels that decorate the structure. The metal was supplied by Reliance Iron and Wire Works, Seattle. This company also received the contract to furnish the ornamental iron and bronze for the building.

The order for aluminum is reported to be the first large aluminum job on the west coast and the largest west of the Mississippi.

H. M. B.

Brass Ingot Statistics

On February 1, unfilled orders for brass and bronze ingots and billets on the books of the members of the Non-Ferrous Ingot Metal Institute, Chicago, Ill., amounted to a total of 15,934 net tons, as compared with 16,373 tons on January 1.

The combined deliveries of brass and bronze ingots and billets by the members of the Institute for January, amounted to 1,261 tons, as compared with 1,492 tons for December, 1932.

Average prices per pound received by the Institute memberships on commercial grades of six principal mixtures of ingot brass during the twenty-eight day period ending February 24, 1933, as follows, with which we supply comparative prices reported for the period ended January 27:

28 Days Ended	Feb. 24	Jan. 27
Commercial 80-10-10 (1% Impurities)	6.076c	6.087c
Commercial 78%	4.504c	4.520c
Commercial 81%	4.750c	4.847c
Commercial 83%	5.019c	5.176c
Commercial 85-5-5-5	5.293c	5.382c
Com. No. 1 yellow	3.915c	4.054c

Use of Copper, Lead and Zinc for Ammunition Off

Declines were noted in United States consumption of copper, lead and zinc for manufacture of ammunition in 1932 as compared with 1931, according to the American Bureau of Metal Statistics, New York. Consumption was as follows, in short tons: 1932, 3,845 tons; 1931, 4,977 tons; zinc, 1932, 1,211 tons; 1931, 1,800 tons; lead, 1932, 3,499 tons for bullets and 19,817 tons for shot; 1931, 5,421 tons for bullets and 24,311 tons for shot.

The returns are from private manufacturers and do not include figures for production by army or navy in its own plants. The copper and zinc chiefly represent the use of those metals for producing cartridge brass.

Big Copper Cable Order

Contracts for a total of 3,000,000 pounds of copper transmission cable were awarded last month by the Los Angeles, Calif., Metropolitan Water District, as follows: Phelps-Dodge Copper Products Corporation, 1,500,000 pounds; Anaconda Wire and Cable Company, 1,100,000 pounds; General Cable Corporation, 400,000 pounds. The cable will be used to supply power for construction work on the Colorado River Aqueduct, a six-year job.

International Nickel Co. Personnel Changes

The following changes have been announced by The International Nickel Company, Inc., New York:

O. B. J. Fraser, formerly in charge of the company's Research Laboratory at Bayonne, N. J., is now located in the Development and Research Department at the company's main offices in New York, where he will be in charge of developments in the uses of nickel and nickel alloys in the oil, gas and coke industries, and in the industrial uses of non-metallic compounds of nickel.

Norman B. Pilling, formerly in charge of metallurgical research, has been placed in charge of the Research Laboratory.

E. M. Wise, whose work heretofore has been largely associated with precious metals, has been appointed assistant.

Business Items—Verified

Chromium Plating Company, Cleveland, Ohio, is reported to be operating at nearly 100 per cent of capacity.

Southern Equipment Company, St. Louis, Mo., kitchen equipment manufacturer, whose plant was recently destroyed by fire, has taken over the plant formerly used by Liberty Foundry Company, and is again in operation.

The Mills Company, Cleveland, Ohio, metal partition manufacturer, has entered the Tulsa, Okla., territory with the appointment of **J. G. Mathews** of the J. G. Mathews Co., 312 Commercial Bldg., Tulsa, as its representative in that district.

Klaas Machine and Mfg. Company, Cleveland, Ohio, has consolidated with **The Weaver Brothers Company,** also of Cleveland. Headquarters are at 4313 East 49th Street. The companies manufacture pickling equipment, tanks, baskets and kindred products.

Waterbury Farrel Foundry and Machine Company, Waterbury, Conn., recently elected officers as follows: **W. S. Fulton,** board chairman; **D. C. Griggs,** president; **R. L. Wilcox, Z. P. Candee,** vice-presidents; **W. D. Pierson,** secretary; **L. S. Reed,** treasurer; the above, with **E. A. Anderson** and **G. R. Lamb** form the board.

Enequist Chemical Company, Inc., 96 Bayard Street, Brooklyn, N. Y., announces that it has two new officers and directors, **Nelson E. Myers** and **Louis H. Cates,** formerly with Seldner and Enequist, Inc. **John Enequist, Jr.,** president, states that he looks forward to increased business as a result of this increased personnel.

Sulphur Products Company, Greensburg, Pa., manufacturer of oxidizing agents, reports improved business. According to **Wilfred S. McKeon,** president, export business is increasing, and general prospects are bright. Specific mention is made of a large order for "Liquid Sulphur," the firm's branded oxidizing agent, from Hockley Chemical Company, Ltd., Birmingham, England, their British distributor.

Farrel-Birmingham Company, Ansonia, Conn., held a stockholders meeting last month at which the following were elected: Franklin Farrel, Jr., board chairman; Nelson W. Pickering, president; D. R. Bowen, Carl Hitchcock, F. R. Hoadley and A. G. Kessler, vice-presidents; F. M. Drew, Jr., treasurer; G. C. Bryant, secretary. Alton Farrel resigned as treasurer because of illness; he had been with the company 30 years, 20 as treasurer. He was succeeded by Mr. Drew.

International Chemical Company, Inc., Philadelphia, Pa., after many years of business under the proprietorship of the late S. D. Benoliel, has been incorporated under Pennsylvania laws. Officers are as follows: President and general manager, **Charles W. Lacey;** vice-president, **Mrs. S. D. Benoliel;** secretary-treasurer, **William S. Louchheim.** Mr. Lacey has been with the company for the past 25 years, having been associated with Mr. Benoliel as factory manager. The firm is a leading manufacturer of industrial cleaning materials, soluble lubricants and other chemicals.

New Corporations

Electro Control Company, Inc., Goshen, Ind.; manufacture electrical products; by William Craig and associates.

Applicraft Corporation, 24 Central Avenue, West Orange, N. J.; manufacture plastic and metal products, novelties, etc.; R. W. Cook, president.

Ace Metal Products Company, 682 South 11th Street, Newark, N. J.; $125,000 capital; manufacture metal goods; by B. J. Wagenbach and associates.

Corporation Reports

Corporations reported the following profits or losses, after charges, for the fiscal year 1932, compared with 1931 figures in parentheses:

Net Profits

American Safety Razor Corporation, New York, $615,756. (Net income $914,683.)

Bridgeport Machine Company, Bridgeport, Conn., $44,744. (No comparison available.)

General Bronze Corporation, New York, $148,384. (Net loss $559,968.)

Hoskins Manufacturing Company, Detroit, Mich., $56,774. ($222,411.)

National Lead Company, New York, $3,301,612. ($4,022,421.)

New Jersey Zinc Company, New York, $2,013,120. ($3,051,589.)

Parker Rust-Proof Company, Detroit, Mich., $264,732. ($449,070.)

Reynolds Metal Company, $1,085,830. ($1,510,900.)

Vulcan Detinning Company, New York, $114,572. ($255,635.)

Net Losses

American Metal Company, Ltd., New York, $2,256,630. (Deficit $615,909 for 1931.)

Baltimore Tube Company, Baltimore, Md., $247,121. (Net loss $175,894.)

Bristol Brass Corporation, Bristol, Conn., $120,523. (Net loss, $12,119.)

National Bearing Metals Corporation, St. Louis, Mo., $162,302. (Net loss, $107,034.)

Ohio Brass Company, Mansfield, Ohio, $878,828. (Net loss $113,773.)

New Haven Clock Company, New Haven, Conn., $629,655. (Net loss $483,957.)

Plume and Atwood Manufacturing Company, Waterbury, Conn., $122,043. (Net income $23,838 for 1931.)

St. Joseph Lead Company, New York, $1,287,711. (Net profit $477,237.)

Savage Arms Corporation, New York, $40,935. (Net loss $566,452.)

United Engineering and Foundry Company, Pittsburgh, Pa., $340,532. (Net profit $953,708.)

Mueller Brass Company, Port Huron, Mich., $309,851 for year ended Nov. 30. (Net loss $385,739 for preceding fiscal year.)

General Cable Corporation. New York. $5,023,840. (Net loss $5,271,551.)

New Haven Clock Company. New Haven, Conn., $629,655. (Net loss $483,957.)

Eagle-Picher Lead Company, Pittsburgh, Pa., $805,106. (Net loss $972,846.)

Driver-Harris Company, Harrison, N. J., $378,671. (Net loss $202,778.)

American Hardware Corporation, $1,348,480. (Loss $1,063,124.)

American Smelting & Refining Company, New York, $4,506,175. (Profit $874,976.)

Bulova Watch Company, Inc., for 9 months to Dec. 31, 1932, $691,469. (Profit $465,715.)

Canada Wire and Cable Company, $283,666. (Profit $291,173.)

General Refractories Company, $2,023,137. (Profit $236,820.)

International Silver Company, Meriden, Conn., $1,567,238. (Loss $1,464,906.)

Landers, Frary and Clark, Connecticut, $75,915. Profit $711,772.)

Manning, Bowman & Co., $125,242. (Loss $259,943.)

Oneida Community Inc., Oneida, N. Y., $1,072,520. (Loss $532,785.)

Scovill Manufacturing Company, Waterbury, Conn., $1,322,933. ($152,912).

Marlin Rockwell Corporation, New York, $123,399. (Loss $23,052.)

News From Metal Industry Correspondents

New England States

Waterbury, Connecticut

MARCH 1, 1933.

Reports are current that the **American Brass Company, Scovill Manufacturing Company** and **Chase Company's, Inc.,** have received orders for brass for shell cases from China and Japan and from Peru and Colombia, as the result of the conflicts there, but officials of the concerns deny them.

Congressman E. W. Goss of this city, associated with the Scovill Co., at the House foreign affairs committee hearing on the proposed embargo on arms, last month, made a sharp denial to a question by Rep. Hill of Illinois if it were not true that "you have got to foment war abroad to have your plants kept in practice." Mr. Goss, with others from this state, asked that the embargo resolution be changed so it would assure that any embargo would include all nations, and asserted that the private arms and munitions industry is the nucleus for the government arms production in time of war, as government arsenals can make but two per cent of the requirements, and that it takes long training to make munitions. He said that during the war he trained men in the casting of brass for cartridges and that it took long experience; that at the Scovill plant it "took us four years to reach a daily production of 30,000 fuses and cases."

Officers of the **Waterbury Clock Company** were re-elected last month as follows: president, James R. Sheldon; vice-president, C. H. Granger; treasurer, George R. Close; secretary, Carl Kraft.

Plume and Atwood Manufacturing Company elected officers last month as follows: president and treasurer, Ralph L. French; vice-president, S. Kellogg Plume; secretary and assistant treasurer, John L. Scott.

Waterbury Buckle Company elected officers as follows: president and treasurer, J. B. Smith; secretary and general manager, Jerome R. LaVigne.

Waterbury Farrel Foundry and Machine Company elected officers as follows: president, David C. Griggs; vice-presidents, R. L. Wilcox and Z. P. Candee; secretary, W. D. Pierson; treasurer, Lewis S. Reed.

Study, with the idea of acceptance, of the so-called Waterbury plan for relieving unemployment, was recommended by the committee on unemployment of the **Manufacturers' Association of Connecticut** last month. **John H. Goss,** vice-president of the Scovill Manufacturing Company, is vice-president of the association. The local plan involves weekly contributions by all employed of a percentage of their salaries, matched by equal amounts from the employers and expended in providing public work for those unemployed.

American Brass Company plants were closed Feb. 14 because of the funeral of **John D. Ryan,** chairman of the **Anaconda Copper Company. John A. Coe,** president of American Brass, was an honorary pallbearer.

Letters have been received by local manufacturers from the **National Barter and Trade Exchange,** New York City, asking if they have a burden of surplus stock which they would exchange for other commodities.

Patents granted to local inventors last month included: **Charles T. Brennan,** cut-off mechanism for ball machines; **Edward S. Cornell,** assignor of the **Chase Companies,** combined check valve and strainer; **Arthur L. Ellis,** assignor of the **Waterbury Tool Company,** typewriting machine.

W. R. B.

Connecticut Notes

MARCH 1, 1933.

HARTFORD—Royal Typewriter Company is expected to show a deficit of $250,000 for 1932 operations, compared with a net income of $359,000 in 1931, largely due to foreign exchange losses and reduced foreign business due to tariff regulations.

Underwood Elliott Fisher Company is expected to have a deficit of $600,000 for 1932, the first since 1927. The net income for 1931 was $1,401,000.

BRISTOL—New Departure Manufacturing Company last month began distribution of $320,000 to 1,070 employes who were members of the 1927 class of the General Motors "Two for one plan." The money is being distributed in cash, General Motors stock or on house contracts and the employes may take their payments as they desire. Many of them are taking the payments in stock. According to the plan an employe was allowed to put up to $300 in 1927, leave it there five years, and the company would add $150 and interest. It was not necessary to put in the entire $300 but those that did are now receiving $621. Because of business conditions the plan was discontinued last March. Money for the classes of 1928, 1929, 1930, 1931 and 1932 will be distributed each year as they mature.

BRIDGEPORT — Remington Arms-Union Metallic Cartridge Company is now operating five days a week, as compared with three days up to the middle of January. Yet business in January was better than in January of last year. It is understood that large orders have been received from South America and China, but **Manager Saunders Norvell** says the increase is due largely to demand for ammunition from sporting lines. He denies there is any truth to

reports of a merger with Winchester Arms.

MERIDEN—Handel Company has been awarded a $15,000 contract for lighting fixtures for two units of 25 proposed state hospital buildings at Newtown. Work must be completed by April 15. The company also has contracts for special and commercial lighting fixtures for the new state office building in Hartford, and for the county courthouse here.

NEW HAVEN—New Haven Clock Company has resumed dividends on the preferred stock, discontinued for over a year, and paid $1.62½ for the quarterly distribution Feb. 1.

H. M. Beebe, manager of the foreign department of the **Winchester Arms Company**, appeared at the hearing before the foreign affairs committee of Congress last month on the proposed munitions embargo. He raised the question as to whether an embargo might be made to include copper, which goes into the manufacture of munitions, and suggested that a future interpretation of what constitutes arms and munitions might not only include copper but cotton, lead, tools and machinery.

STAMFORD—Yale and Towne Manufacturing Company is now employing 1,600 hands three and four days a week. The average time recently has been 38 hours a week.

SOUTHINGTON—Southington Hardware Manufacturing Company declared a dividend of 25 cents a share, payable Feb. 1.

CHESTER—Comstock-Cheney Company, novelty manufacturer, has resumed operations, having been closed for four months.

TORRINGTON—American Brass Company plant was closed all day Feb. 14 due to the death of John D. Ryan, chairman of the board of directors of the Anaconda Copper Mining Company.

W. R. B.

Providence, Rhode Island

MARCH 1, 1933.

Rhode Island is watching with interest the fate of an act presented by Senator Kierman of North Providence, to the General Assembly, providing for establishment of a 'wage board" to determine "fair wage standards" for women and minors, and to prevent exploitation of such labor. In disputes the board would consist of the Commissioner of Labor, three citizens named by him, three delegates of employes and three representatives of employers. This bill is in line with a similar project under way in Massachusetts.

Jesse C. Hambly, assistant secretary and assistant treasurer of the **New England Butt Company** for the past 15 years, died Feb. 5, after a short illness.

Arthur L. Aldred, 65, a director of **Gorham Manufacturing Company** and **Alvin Silverware Company**, and a former president of the Providence Chamber of Commerce, died Feb. 8 at his home here.

Edmund C. Mayo, president of **Gorham Manufacturing Company**, has been elected a director and president of **United States Bobbin and Shuttle Company.**

Ober Jewelry Manufacturing Company, 220 Eddy Street, has been given a contract by the War Department to supply the army with 64,000 bars to decorate soldiers for distinction in target practice. Contract will amount to $1,849.

Five hundred delegates and guests from all parts of New England are expected to attend the twenty-third annual convention of the **New England Builders' Supply Association**, to be held in Providence, Feb. 16. **Thomas G. Bradshaw**, of Providence, president of the association is in charge of arrangements.

The plants of the **Sherman Jewelry Manufacturing Company**, and the **Martin Enameling Company**, in the building at 74 Clifford Street, were damaged during a fire in the lower part of the building on Jan. 27.

Universal Chain Company, Inc., of Maplewood, N. J., has opened a branch office at 61 Peck Street, Providence, in charge of **Adolf Schraysshuen**, to give the New England trade prompt delivery.

Enamels Craft Corporation of Providence has leased factory space at New Haven, Conn., and will begin manufacture of metal novelties shortly, employing 100 hands.

Gorham Manufacturing Company directors have deferred action on common stock dividend, usually due at this time, until the next quarterly meeting. The company paid 25 cents on common stock the last quarter of 1932, bringing the 1932 total payment to $1.30 per share.

New Rhode Island Corporations:

Combination Pen & Pencil Corp.: 100 shares no par common; by R. H. Crossley and associates.

J & H Jewelry Company; 100 no par common shares; by Morris Golin, 210 Early Street, and associates.

New England Lacquer Company, East Providence, R. I.; to deal in lacquers; authorized capital, $20,000 in shares of several kinds; by E. A. Jenkes and M. and D. Swan.

P & S Polishing and Plating Company; 100 no par common shares; by M. A. Peisach and associates.

S & S Jewelry and Novelty Company, Inc., Cranston; $50,000 capital in $100 common shares; by M. A. Schulze and associates, 39½ Redwing Street, Providence.

W. H. M.

Middle Atlantic States

Trenton, New Jersey

MARCH 1, 1933.

William C. Hipple, superintendent of the Trenton Plant of the Westinghouse Lamp Company, has informed the Emergency Relief Administration that the concern will aid the present employes and those it has employed since the depression began. The company will issue food orders and to provide medical and other needs in some cases. Mr. Hipple says the work is a company policy.

Following concerns have been chartered here:

Hy-Test Lamp Works, Inc.; lamps, 50 shares stock; headquarters at Newark. **Star Terminal Company, Inc.**; battery terminals; $50,000; Merchantville. **Grimm Foundry Company**; $150,000 preferred, $150,000 common; Bridgewater. **Volkmer Manufacturing Company**; radio tubes; $125,000; Bloomfield. **Welding Supply Co., Inc.**; $20,000; Hillsdale. **Atlas Sanitary Products, Inc.**; $125,000; North Wildwood.

C. A. L.

Newark, New Jersey

MARCH 1, 1933.

Activity has been better in some of the metal plants here the past month.

Duralac Chemical Company, has purchased a section of the former Lister plant on Lister Avenue

Davis Electric Company, Central Avenue, has purchased a property opposite its establishment for use as a factory and office building. About $10,000 will be spent in improvements.

Prospect Tank Installation Company, New Brunswick, has leased a brick building on Clifford Street for a warehouse.

Davis Laboratories, Inc., has leased portion of a building on Frelinghuysen Avenue. Concern will move from Hillside, N. J., and will continue to manufacture auto enamel, gaskets, etc.

Judge Nicholas Albano has been appointed custodian receiver for the **Peerless Blade Corporation**, Irvington, N. J., manufacturers of razor blades.

C. A. L.

Central New York

MARCH 1, 1933.

At the beginning of March there is apparently no improvement in the outlook for the metal trades in Central New York. Here and there plants report getting orders, but the general tone of the industry as reported in the Mohawk Valley towns is far from optimistic.

A less discouraging message comes from Sherrill, where a report states that "since the majority of citizens residing in this town are employed by the **Oneida Community, Ltd.**, the situation is less complicated." While it is true the factories of the Community are working on greatly reduced schedules, suffering has been eliminated by the wives of company directors, who have taken the responsibility of aiding families in need. Miss Anna Blust, chief nurse of Oneida Community, Ltd., who also works with the City Welfare Board, reports there are no Sherrill families in actual need.

Protracted litigation between two silver manufacturers over the right to use the word "Rogers" on their products brought a voluminous opinion in February from United States Judge Frank

Cooper. **The International Silver Company** sought to enjoin the **Oneida Community, Ltd.,** from using the word. In 1929 the Oneida group bought the old Rogers silverware and plating business. With the business the Oneida group bought the trade marks from William A. Rogers, Ltd., a Canadian concern.

The International Silver Company contended that it alone held the right to use the name, claiming right to succession from the three Rogers brothers, Simeon, William and Asa, manufacturers of plated ware more than 70 years ago.

"The defendant may sell goods as Rogers," Judge Cooper wrote, "so long as it does no more and does not represent them as plaintiff's Rogers goods or induce its customers to do so."

Howard W. Partlow, president of the **Partlow Corporation,** New Hartford, N. Y., reported that business is good with his concern. The corporation uses large quantities of mercury, brass and nickel to manufacture thermostatic heat controls and safety devices. Recent orders have come from Japan and Egypt.

"Wherever heat is required in the process of manufacture and apparatus is used to control it there is a market for our product," Mr. Partlow said. Newer products put on the market recently by Partlow include an urn control for restaurant coffee, an electric temperature control, and a foolproof safety control for gas ovens.

E. K. B.

Middle Western States

Detroit, Michigan

MARCH 1, 1933.

Manufacturers and platers, as well as those engaged in other lines, awoke Tuesday morning, February 14, to find that all banks in the Lower Michigan Peninsula were on a holiday for 8 days. The only currency obtainable was that which chanced to be in use outside the bank vaults. Pay day was near at hand, and a crusade was started to obtain funds outside the state. A day or two later, under permission from Gov. Comstock, who declared the holiday to prevent disaster to the state banking business, customers were permitted to draw up to 5 per cent of their deposits.

It is easily imagined what the holiday did to business. In spite of liberal favors, contracting and general buying slumped off to a startling degree. Available funds were conserved in every possible way. This acute situation naturally was reflected strongly in the metal industry, which was just beginning to see some light as a result of the spring automobile revival. It was necessary to import great sums of currency in order to meet payrolls. Payments in many instances were made in cash. Some plants opened temporary banking places of their own where they cashed checks from funds received from outside the state. It is difficult to say when the situation will be cleared up.

While manufacturing did not promise any great rush, conditions previous to this financial upset apparently were shaping themselves for much better things. Most of the automobile plants were getting into production. They still are making progress, but it is difficult to forecast what the next few weeks have in store. Accessory, body manufacturing and plating plants are all getting well under way in spite of the fact that they were hampered for some weeks by serious strikes. Even these are not fully settled, although they do not loom so seriously as a few weeks ago. The banking situation, however, is giving much concern.

Charles A. Young, manufacturer, died in Detroit on February 10. He was 74 years old, and had been ill about three weeks in a local hospital. He was born November 1, 1858, at Windsor, Ont. At 24 he became superintendent of the Detroit Sheet Metal and Brass Company. In 1896 he resigned to organize the Young Brothers Company, manufacturers of industrial ovens, with himself as president. He leaves a widow, a daughter, a brother and a sister.

Chevrolet reports sales during the first 10 days of February totaled 10,544 units, a gain of 9.2 per cent over a like period in 1932.

Coldwater Brass Company, Coldwater, Mich., manufacturer of plumbers' supplies, has been incorporated. The capital stock is $10,000.

Mueller Brass Company and the **Scott Valve Manufacturing Company** were among the outstanding sponsors of the Building Show which was held in Detroit from March 4 to March 12.

Announcement is made that the advertising of the **American Injector Company** and the **Bundy Tubing Company,** both prominent Detroit Manufacturers, is now being planned and handled by Holden, McKinney and Clark, Inc., Detroit advertising agency.

F. J. H.

Cleveland, Ohio

MARCH 1, 1933.

This area seems to be more favored than most Great Lakes industrial centers. Spring business campaigns are getting well under way, and manufacturers are looking forward to improved conditions.

The financial upset in the Michigan area may have a moderate effect on those engaged in producing automobile accessories. The automotive industry, however, seems to be going right ahead, and every one is hoping it will continue, although no one is expecting an approach to the activity of other years.

Cleveland is a city of varied industries. Some getting into production with prospects of further increases. The plating industry is making some progress and should develop better conditions as the season advances.

Toledo, Ohio

MARCH 1, 1933.

Activity in nonferrous metals and plating has changed little during the last month. Most plants are in production, largely on automobile parts. Many workers are engaged but no one knows just how long they will continue. Every one is hoping operations will continue well into the Spring.

The bad Michigan banking situation contributed much uncertainty during the last week or two. Thus far it has not actually slowed up the motor car industry, although it has resulted in some annoying features. It is exceedingly regretted that this financial upset in Detroit should have developed just at a time motor car manufacturers were getting spring campaigns under way.

Willys-Overland Company was placed in receivership on February 15. John N. Willys, chairman of the board and L. A. Miller, president, are the receivers. The action was started in the name of the **Monroe Auto Equipment Company,** a creditor, following an all-day conference. It is described unofficially as a friendly action to protect stockholders and conserve assets.

Chicago, Illinois

MARCH 1, 1933.

Chicago industry as a whole is marking time. Wholesale and retail trade shows a gain, local steel mills maintain operating rate of close to 18 per cent of capacity, automobile shows resulted in a favorable number of orders, and a few manufacturers in various lines have increased production schedules, but no noticeable upturn is felt as yet. Some expansion in plant facilities and in advertising appropriations, however, show efforts to prepare to handle increased orders. Within the past week there has been a sudden large demand for printing by various exhibitors at the forthcoming Century of Progress Exposition, which indicates that activity along this line is about to start in a big way.

International Harvester Company has purchased a three-story factory on Western Avenue from John Fitzpatrick Company for a stated $60,000. International has a million dollar program for plant expansion and improvement. Facilities are to be provided for production of the new baby tractor for farm service, including parts production and assembling.

Elgin National Watch Company, Elgin, Ill., has increased its production schedule, adding to the working force. Employment at the plant is greatest in the past eight months.

Central Metallic Casket Company has

purchased a modern three story plant at 2333-34 Logan Boulevard for $75,000, and plans extensive alterations which will make this plant thoroughly modern.

Aluminum Products Company, La Grange, Ill., had a 1932 production payroll 35 per cent greater than that of 1931, and a power consumption increase of 30 per cent. Production is on a 20-hour schedule. The concern, said to be the only independent aluminum rolling mill west of Pittsburgh, has recently added new lines such as the manufacture of insulated sporting goods equipment.

An increase of approximately 50 per cent over 1932 in its 1933 advertising budget is announced by B. D. Ritholz, vice president of **Dr. Ritholz Optical Company,** manufacturers and retailers of ated $250,000 for advertising, an increase of $80,000.

Waco Aircraft Company, Troy, Ill., has received an order from the Brazilian government for ten war planes amounting to $100,000.

All retiring directors of the **Wahl Company** were re-elected at the annual stockholders meeting. **Carl W. Priesing** was elected a vice-president at the board meeting, succeeding **A. A. Herschler.**

Excel Auto Radiator Company has leased the entire second floor at 320 East 21st Street. The concern had been at 1827 South Michigan Avenue for ten years.

Cairo Manufacturing Company, now operating the Tideman plant, has received a $20,000 contract for making visual pumps for the National Pumps Corporation, Dayton, Ohio.

H. C. Bonfig, formerly general manager of the Sterling Radio Company, Kansas City, Mo., has been appointed sales manager for The Grunow Corporation.

New Chicago Corporations:

Franklin Die Casting Company, 2535 Greenview Avenue; capitalization, $40,000 common.

King Pneumatic Tool Company, 2717 North Ashland Avenue; $50,000 common.

Streator Metal Stampings Corporation, Streator, Ill.; $100,000; metal stampings, carpet sweepers, and kindred products. R. G. K.

Pacific States

March 1, 1933.

The **Hoover Dam** project will require great quantities of copper, brass, aluminum, lead and other nonferrous metals. Contracts are shortly to be let for the wire which will carry the electricity to be generated from the dam to Los Angeles and other southern California cities. There has been some rivalry between copper and aluminum cable.

Arizona copper men have been in California recently, to urge greater use of copper in order to aid western business. The metal is in poor demand, however, and the price is low.

Prof. H. W. Edwards of the University of California, has developed a new process for making mirrors which involves deposition of aluminum and magnesium on glass. The product is said to reflect up to 90 per cent of the light, and more of the ultra violet rays, and is expected to find a market in the optical business.

Standard Fence Company, a new concern, has leased 24,000 sq. ft. at 3020 San Fernando Road, Los Angeles, and will manufacture wire products. Investment is said to be $40,000. **G. K. Smith** is general manager.

Gas Burner Company, 88 Second Street, San Francisco, is a new concern which will distribute nationally. **H. A. Tuckey** is secretary.

Standard Gas Engineering Company, San Francisco, will spend $20,000 for plant modernization.

Merco Nordstrom Valve Company, San Francisco, will spend $3,000 for new equipment.

Electrical Products Corporation, San Francisco, will build a new plant at considerable expense.

Pacific Coast Engineering Company, San Francisco, has developed duplicating machinery for punching plates, angles, etc.

Pelton Water Wheel Company, San Francisco, will spend $5,000 for improvements.

General Engineering and Dry Dock Company, San Francisco, will spend $5,000 for improvements at San Pedro plant, Los Angeles. Company has spent $128,000 for improvements at San Francisco.

Steiger and Kerr Stove and Foundry Company, San Francisco, has spent $22,000 for plant improvements.

P. and L. Specialty Company, 502 Sixth Street, San Francisco, is manufacturing a line of cold solders.

Apex Manufacturing Company, Oakland, at Emeryville section, is manufacturing a line of can and bottle openers, knife sharpeners, etc.

Meets-a-Need Mfg. Company, Seattle, Wash., is manufacturing metal articles.

Charles Semmens has bought **Longtin's Sheet Metal Works,** 211 Oak Street, Anaconda, Mont.

Bay Casket Company is a new firm at 423 Hayes Street, San Francisco. **William Bourdett** is general manager.

L. L. Woods, 95 North 12th Street, Portland, Ore., is making stainless steel kitchen ware.

Wells Mfg. Company, San Francisco, is making a special line of waffle bakers and automatic fryers. **C. J. Erickson** is treasurer.

Aeroil Burner Company, 469 Bryant Street, San Francisco, is making a line of powerful torches for pest extermination.

McCorkle-Nugent Company, 354 Hobart Street, Oakland, is making a new temperature control for gas fired heaters and furnace appliances.

H. S.

Metal Market Review

March 1, 1933.

Copper

The price of copper remained unchanged throughout the month of February, electrolytic holding at 5.00 cents a pound delivered Connecticut points.

Business was fair as compared with the latter part of 1932. While consumers are not by any means laying in immense stocks, still they are ready to buy at 5 cents whenever they see a chance to use up the metal within a reasonable time. The February business was largely for second quarter delivery. There were inquiries for third quarter metal, presumably at 5 cents, but sellers were disinclined to take such forward business. Consumers are looking forward to two factors which may affect the copper price: some effective production curtailment plan, and a possible increase in manufacturing activity over the latter part of the year.

Lead

Business in lead last month was spotty. At times demand was fairly brisk. The price held steadily enough at 2.875 cents East St. Louis (3 cents New York). Despite the fact that figures for January production and shipments showed an increase of over 8,500 tons in surplus stocks, the quotation was well maintained as producers did not press metal for sale. The indication is, therefore, that producers have determined not to sacrific the price any further. This is logical in view of the apparent disparity between production costs and selling prices. On the other hand, users of metal have not shown any tendency to buy beyond their immediate requirements, feeling that the price level is not very likely to skyrocket without notice.

Zinc

Reduced consumption, increasing surplus stocks, and the desire of some producers to realize on their holdings all had their effect on the price of zinc last month. The average for February fell to 2.678 cents East St. Louis, or about 0.35 cents below the January average. At the month-end the price held at 2.65 cents for Prime Western, East St. Louis.

Despite the economic condition which is affecting zinc just as it is the other metals, the producers continue to show confidence in the future. Markets are being developed by adapting zinc to new uses, improving the old zinc products, and in general showing a progressive attitude which is bound to accrue to the benefit of the industry finally.

Tin

Tin business continues on a restricted basis, in line with the low volume of tin plate production by the steel industry. In comparison with the other metals, and in view of general conditions, however, business in tin last month was fair. The average daily price of prompt Straits tin at New York for February was 23.497 cents, as against a January average of 22.70 cents. Deliveries to the United States in February were 3,045 tons, against 3,725 tons in January, the reduction being attributed to the fact that February has three days less than January. Stocks in this country were decreased by 720 tons last month.

With the producers managing to keep control of production, the outlook is for a continuance of the steady market.

Other Metals

Aluminum—There has been no change in the quotations on aluminum, the base price remaining 23.30 cents per pound for Alcoa commercial and mill ingot, 99.98 per cent.

Antimony—The daily price average for February, 5.758 cents, for Chinese antimony was slightly higher than the January average. At the close of the month the price held at 5.75 cents.

Silver—Silver remained steady throughout most of the mouth, but toward the end it weakened as a result of news that the present session of Congress would take no action on pending silver bills. Some speculative purchases were liquidated. After going as high as 27.25 cents the price declined to a month-end level of 26.50. The average for February, 26.090 cents, was well above the January average of 25.435.

Platinum—Prices remained unchanged, with the leading interest quoting $24 per ounce, and metal available at several dollars less from dealers.

Scrap Metals—Scrap metal business remained on a fairly steady keel through February. There was activity in export business, rather than in domestic and the list of prices (shown on the opposite page) remained in general unchanged.

The Wrought Metal Market

MARCH 1, 1933.

Copper, brass and bronze wrought metals, except copper wire, were advanced ½c. per pound on March 1. This was the first change since January 2.

The automobile industry has been absorbing a fair amount of sheets, tubing and other forms of nonferrous material, despite the temporary disturbances caused by labor difficulties. This points to an increasing demand for nonferrous metals for accessory manufacture, at least as long as automobile production is kept up.

The use of metals in other fields of industry remains restricted, but here and there a bright spot appears. There is a steady trend toward nonferrous metals for architectural purposes, and for household equipment. The exhibit of Industrial Arts at New York recently showed a steadily growing tendency toward the use of brightly polished or otherwise finished nonferrous metals for kitchen sinks, tables, lighting equipment and utensils. Air conditioning, as previously pointed out here, presents one of the biggest new fields for nonferrous metal application. If air conditioning is applied widely to large building construction, and then to dwellings, huge amounts of copper sheets, tubing (which is tin plated to a large extent for refrigeration purposes), and cast and wrought metals (for grilles, registers, etc.) will go into consumption.

Wrought metals and alloys should benefit to a great extent by their display and use at the coming international exposition of A Century of Progress, which will open in June at Chicago. Among the features already announced are the use of a continuous triple line of copper bus bar for 1,200 feet around the Central Station Exhibit in the Electrical Building; an all-metal, porcelain enameled house; and many exhibits of nickel, aluminum, zinc, lead, brass and bronze, and the multitude of alloys into which these metals are combined.

Daily Metal Prices for February, 1933

Record of Daily, Highest, Lowest and Average Prices and the Customs Duties

	1	2	3	6	7	8	9	10	13*	14	15	16
Copper c/lb. Duty 4c/lb.												
Lake (Del.)	5.00	5.00	5.00	4.90	4.90	4.90	4.90	4.90	....	4.90	4.90	4.90
Electrolytic (Conn.)	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	....	5.00	5.00	5.00
Casting (f.o.b. ref.)	4.75	4.75	4.75	4.75	4.75	4.75	4.75	4.75	....	4.75	4.75	4.75
Zinc (f.o.b. St. L.) c/lb. Duty 1¾c/lb.												
Prime Western	2.85	2.80	2.80	2.80	2.75	2.65	2.65	2.65	....	2.625	2.60	2.60
Brass Special	2.90	2.85	2.85	2.85	2.80	2.70	2.70	2.70	....	2.675	2.65	2.65
Tin (f.o.b. N. Y.) c/lb. Duty Free												
Straits	23.25	23.40	23.50	23.75	23.70	23.60	23.80	23.70	....	23.60	23.50	23.50
Pig 99%	22.10	22.25	22.35	22.60	22.50	22.40	22.60	22.50	....	22.45	22.35	22.25
Lead (f.o.b. St. L.) c/lb. Duty 2¼c/lb.	2.875	2.875	2.875	2.875	2.875	2.875	2.875	2.875	....	2.875	2.875	2.875
Aluminum c/lb. Duty 4c/lb.	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	....	23.30	23.30	23.30
Nickel c/lb. Duty 3c/lb.												
Electrolytic 99.9%	35	35	35	35	35	35	35	35	....	35	35	35
Shot (from remelted electrolytic)	36	36	36	36	36	36	36	36	....	36	36	36
Pellets 99.5-100%	40	40	40	40	40	40	40	40	....	40	40	40
Antimony (Ch. 99%) c/lb. Duty 2c/lb.	5.80	5.80	5.80	5.75	5.75	5.75	5.75	5.75	....	5.75	5.75	5.75
Silver c/oz. Troy Duty Free	25.875	25.625	25.625	25.875	25.50	25.75	25.50	25.50	....	25.75	25.75	25.875
Platinum $/oz. Troy Duty Free	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	....	22.00	22.00	22.00

	17	20	21	22*	23	24	27	28	High	Low	Aver.
Copper c/lb. Duty 4c/lb.											
Lake (Del.)	4.90	4.90	4.90	....	4.90	4.90	4.90	4.90	5.00	4.90	4.917
Electrolytic (Conn.)	5.00	5.00	5.00	....	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Casting (f.o.b. ref.)	4.75	4.75	4.75	....	4.75	4.75	4.75	4.75	4.75	4.75	4.75
Zinc (f.o.b. St. L.) c/lb. Duty 1¾c/lb.											
Prime Western	2.60	2.60	2.60	....	2.625	2.65	2.675	2.675	2.85	2.60	2.678
Brass Special	2.65	2.65	2.65	....	2.675	2.70	2.725	2,725	2.90	2.65	2.728
Tin (f.o.b. N. Y.) c/lb. Duty Free											
Straits	23.55	23.60	23.40	....	23.40	23.30	23.20	23.20	23.80	23.20	23.497
Pig 99%	22.30	22.35	22.15	....	22.20	22.10	22.00	22.00	22.60	20.00	22.303
Lead (f.o.b. St. L.) c/lb. Duty 2¼c/lb.											
Aluminum c/lb. Duty 4c/lb.	2.875	2.875	2.875	....	2.875	2.875	2.875	2.875	2.875	2.875	2.875
Nickel c/lb. Duty 3c/lb.	23.30	23.30	23.30	....	23.30	23.30	23.30	23.30	23.30	23.30	33.30
Electrolytic 99.9%	35	35	35	....	35	35	35	35	35	35	35
Shot (from remelted electrolytic)	36	36	36	....	36	36	36	36	36	36	36
Pellets 99.5-100%	40	40	40	....	40	40	40	40	40	40	40
Antimony (Ch. 99%) c/lb. Duty 2c/lb.	5.75	5.75	5.75	....	5.75	5.75	5.75	5.75	5.80	5.75	5.758
Silver c/oz. Troy Duty Free	26.125	27.00	27.00	....	27.25	26.625	26.50	26.50	27.25	25.50	26.090
Platinum $/oz. Troy Duty Free	22.00	22.00	22.00	....	20.50	20.50	20.50	20.50	22.00	20.50	21.667

*Holiday.

Metal Prices, March 3, 1933

(Import duties and taxes under U. S. Tariff Act of 1930, and Revenue Act of 1932)

NEW METALS

Copper: Lake, 5.12½. Electrolytic, 5.12½. Casting, 4.75.
Zince: Prime Western, 2.70. Brass Special, 2.75.
Tin: Straits, 23.75. Pig, 99%, 22.50.
Lead: 2.875. Aluminum, 23.30. Antimony, 5.75.
Nickel: Ingot, 35. Shot, 36. Elec., 35. Pellets, 40.
Quicksilver: Flask, 75 lbs., $50. **Bismuth,** 85.
Cadmium, 55. **Silver,** Troy oz., official price, N. Y., March 6, 29.75.
Gold: oz., Troy, $20.67. **Platinum,** oz., Troy, $22 to $24.

Duties: Copper, 4c. lb.; zinc, 1¾c. lb.; tin, free; lead, 2½c. lb.; aluminum, 4c. lb.; antimony, 2c. lb.; nickel, 3c. lb.; quicksilver, 25c. lb.; bismuth, 7½%; cadmium, 15c. lb.; cobalt, free; silver, free; gold, free; platinum, free.

INGOT METALS AND ALLOYS

	Cents lb.	U. S. Import Duty	Import Tax*
Brass Ingots, Yellow	4 to 5¾	None	4c. lb.[1]
Brass Ingots, Red	5¾ to 7½	do	do
Bronze Ingots	6 to10	do	do
Aluminum Casting Alloys	8 to22½	4c. lb.	None
Manganese Bronze Castings	16 to30	45% a. v.	3c. lb.[2]
Manganese Bronze Forgings	22 to33	do	do
Manganese Bronze Ingots	6 to10	do	4c. lb.[1]
Manganese Copper, 30%	15 to22½	25% a. v.	3c. lb.[2]
Monel Metal Shot or Blocks	.. 28	do	None
Phosphor Bronze Ingots	6½to10	None	4c. lb.[1]
Phosphor Copper, guaranteed 15%	9½to15	3c. lb.[2]	do
Phosphor Copper, guaranteed 10%	9 to14	do	do
Phosphor Tin, no guarantee	30 to45	None	None
Silicon Copper, 10%	18 to30	45% a. v.	4c. lb.[1]
Iridium Platinum, 5%	$24.00	None	None
Iridium Platinum, 10%	$25.00	None	None

*Duty is under U. S. Tariff Act of 1930; tax under Section 60 (7) of Revenue Act of 1932.
[1]On copper content. [2]On total weight. "a. v." means ad valorem.

OLD METALS

Dealers' buying prices, wholesale quantities:	Cents lb.	Duty	U. S. Import Tax
Heavy copper and wire, mixed	3¼to 3½	Free	4c. per pound on copper content.
Light copper	2¾to 3	Free	
Heavy yellow brass	1⅝to 1⅞	Free	
Light brass	1¼to 1½	Free	
No. 1 composition	2½to 2¾	Free	
Composition turnings	2⅜to 2½	Free	
Heavy soft lead	2⅛to 2¼	2⅛c. lb.	
Old zinc	1 to 1⅛	1½c. lb.	
New zinc clips	1⅜to 1⅝	1½c. lb.	
Aluminum clips (new, soft)	10 to11	4c. lb.	
Scrap aluminum, cast, mixed	3¾to 4	4c. lb.	
Scrap aluminum, sheet (old)	8½to 9	4c. lb.	None.
No. 1 pewter	12½to13½	Free	
Electrotype or stereotype	1¾to 2	2⅛c. lb.*	
Nickel anodes	22 to24	10%	
Nickel clips and turnings	17 to25	10%	
Monel scrap	5¾to 9¾	10% a. v.	

*On lead content.

Wrought Metals and Alloys

The following are net BASE PRICES per pound, to which must be added extras for size, shape, small quantity, packing, etc., as shown in manufacturers' price lists, effective March 1, 1933.

COPPER MATERIAL

	Net base per lb.	Duty*
Sheet, hot rolled	13⅛c	2½c. lb.
Bare wire, soft	8c.	25% a. v.
Seamless tubing	11⅞c.	7c. lb.
Soldering coppers	14¼c.	45% a. v.

*Each of the above subject to import tax of 4c. lb. under Revenue Act of 1932, in addition to duty.

BRASS AND BRONZE MATERIAL

Net base prices per pound, mill shipments.

	High Brass	Low Brass	Bronze	Duty	
Sheet	10½c.	11⅞c.	12c.	4c. lb.	U. S. Import Tax 4c. lb. on copper content
Wire	10½c.	11⅝c.	12c.	25%	
Rod	8c.	11⅜c.	11¾c.	4c. lb.	
Angles, channels	18½c.		20c.	12c. lb.	
Seamless tubing	12¾c.		14¼c.	8c. lb.	
Open seam tubing	18½c.		20c.	20% a.v.	No tax.

NICKEL SILVER

Net base prices per lb. (Duty 30% ad valorem.)

Grade "A" Sheet Metal		Wire and Rod	
10% Quality	19⅛c.	10% Quality	22c.
15% Quality	21¼c.	15% Quality	26⅜c.
18% Quality	22½c.	18% Quality	29⅝c.

TOBIN BRONZE AND MUNTZ METAL

(Duty 4c. lb.; import tax 4c. lb. on copper content.)

Net base prices per pound.	
Tobin Bronze Rod	11¾c.
Muntz or Yellow Metal Sheathing (14"x18")	12⅝c.
Muntz or Yellow Rectangular sheet other sheathing	12⅝c.
Muntz or Yellow Metal Rod	9c.

ALUMINUM SHEET AND COIL

(Duty 7c. per lb.)

Aluminum sheet, 18 ga., base, ton lots, per lb.	32.30
Aluminum coils, 24 ga., base price	30.00

ROLLED NICKEL SHEET AND ROD

(Duty 25% ad valorem, plus 10% if cold worked.)

Net Base Prices

Cold Drawn Rods	50c.	Cold Rolled Sheet	60c.
Hot Rolled Rods	45c.	Full Finished Sheet	52c.

MONEL METAL SHEET AND ROD

(Duty 25% ad valorem, plus 10% if cold worked.)

Hot Rolled Rods (base)	35	Full Finished Sheets (base)	42
Cold Drawn Rods (base)	40	Cold Rolled Sheets (base)	50

SILVER SHEET

Rolled sterling silver (March 6) 33.00c. per Troy oz. upward according to quantity. (Duty, 65% ad valorem.)

ZINC AND LEAD SHEET

	Cents per lb. Net Base	Duty
Zinc sheet, carload lots, standard sizes and gauges, at mill, less 7 per cent discount	9.00	2c. lb.
Zinc sheet, full casks (jobbers' price)	9.25	2c. lb.
Zinc sheet, open casks (jobbers' price)	10.00to10.25	2c. lb.
Full Lead Sheet (base price)	6.50	2¾c. lb.
Cut Lead Sheet (base price)	6.75	2¾c. lb.

BLOCK TIN, PEWTER AND BRITANNIA SHEET

(Duty free)

This list applies to either block tin or No. 1 Britannia Metal Sheet, No. 23 B. & S. Gauge, 18 inches wide or less; prices are all f. o. b. mill:

500 lbs. or over	15c. above N. Y. pig tin price
100 to 500 lbs.	17c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price

Lighter gauges command "extras" over the above prices.

Supply Prices, March 6, 1933

ANODES

Copper: Cast ..... 13½c. per lb.
Rolled, sheets, trimmed ..... 12¼c. per lb.
Rolled, oval ..... 11¾c. per lb.
Brass: Cast ..... 12¾c. per lb.
Zinc: Cast ..... 8½c. per lb.

Nickel: 90-92% ..... 42c. to 46c. per lb.
95-97% ..... 43c. to 47c. per lb.
99% cast, 45c. to 49c.; rolled, depolarized, 46c. to 50c.
Silver: Rolled silver anodes .999 fine were quoted March 6 from 33.00c., per Troy ounce upward, depending upon quantity.

WHITE SPANISH FELT POLISHING WHEELS

Diameter	Thickness	Under 50 lbs.	50 to 100 lbs.	Over 100 lbs.
10-12-14 & 16	1" to 2"	$2.85/lb.	$2.55/lb.	$2.35/lb.
10-12-14 & 16	2 to 3½	2.75	2.45	2.25
6-8 & over 16	1 to 2	2.95	2.65	2.45
6-8 & over 16	2 to 3½	2.90	2.60	2.35
6 to 24	Under ½	4.15	3.85	3.65
6 to 24	½ to 1	3.85	3.55	3.35
6 to 24	Over 3½	3.25	2.95	2.75
		Any Quantity		
4 to 6	Under ½, $4.90	½-1, $4.75	1 to 3, $4.65	
1½ to 4	" 5.45	" 5.30	" 5.25	
1 to ½	" 5.75	" 5.60	" 5.50	

Extras: 25c. per lb. on wheels, 1 to 6 in. diam., over 3 in. thick. On grey Mexican wheels deduct 10c. per lb. from above prices.

COTTON BUFFS

Full disc open buffs, per 100 sections when purchased in lots of 100 or less:

11" 20 ply 64/68 Unbleached	$14.49 to 16.60
14" 20 ply 64/68 Unbleached	24.28 to 27.40
11" 20 ply 80/92 Unbleached	16.61 to 18.70
14" 20 ply 80/92 Unbleached	27.83 to 31.10
11" 20 ply 84/92 Unbleached	20.33 to 25.05
14" 20 ply 84/92 Unbleached	34.04 to 41.95

Sewed Pieced Buffs, per lb., bleached ..... 30c. to 70c.

CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone	lb.	.08-.09½
Acid—Boric (Boracic) granular, 99½+% ton lots	lb.	.04½-.05
Chromic, 75 to 400 lb. drums	lb.	.12-.17½
Hydrochloric (Muriatic) Tech., 20 deg., carboys	lb.	.02
Hydrochloric, C. P., 20 deg., carboys	lb.	.06
Hydrofluoric, 30%, bbls.	lb.	.08-.12
Nitric, 36 deg., carboys	lb.	.06-.06½
Nitric, 42 deg., carboys	lb.	.07-.08
Sulphuric, 66 deg., carboys	lb.	.02
Alcohol—Butyl	lb.	.10½-.12
Denatured drums	gal.	.475-.476
Alum—Lump, barrels	lb.	.03¼-.04
Powdered, barrels	lb.	.03½-.05
Ammonia, aqua, com'l., 26 deg., drums, carboys	lb.	.02¾-.05
Ammonium—Sulphate, tech., bbls.	lb.	.03½-.05
Sulphocyanide, technical crystals	lb.	.28-.37
Arsenic, white, kegs	lb.	.04½-.05
Asphaltum	lb.	.35
Benzol, pure	gal.	.58
Borax, granular, 99½+%, ton lots	lb.	.02¼-.02¾
Cadmium oxide, 50 to 1,000 lbs.	lb.	.55
Calcium Carbonate (Precipitated Chalk)	lb.	.05¾-.07½
Carbon Bisulphide, drums	lb.	.05½-.12
Chrome Green, bbls.	lb.	.19
Chromic Sulphate	lb.	.30-.40
Copper—Acetate (Verdigris)	lb.	.20
Carbonate, bbls.	lb.	.14-.20
Cyanide (100 lb. kgs.)	lb.	.39
Sulphate, bbls.	lb.	2.75-5.25
Cream of Tartar Crystals (Potassium Bitartrate)	lb.	.20¼-.20½
Crocus	lb.	.15
Dextrin	lb.	.05-.08
Emery Flour	lb.	.06
Flint, powdered	ton	$30.00
Fluorspar, bags	lb.	.04½
Gold Chloride	oz.	$12.00
Gum—Sandarac	lb.	.26
Shellac	lb.	.32-.34
Iron Sulphate (Copperas), bbls.	lb.	.01½
Lacquer Solvents	gal.	.85
Lead—Acetate (Sugar of Lead)	lb.	.09-.13
Yellow Oxide (Litharge)	lb.	.12½
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Methanol, 100% synth., drums	gal.	.41½
Nickel—Carbonate, dry, bbls.	lb.	.32
Chloride, bbls.	lb.	.16-.21
Salts, single, 300 lb. bbls.	lb.	.11-.13
Salts, double, 425 lb. bbls.	lb.	.11-.13
Paraffin	lb.	.05-.06
Phosphorus—Duty free, according to quantity	lb.	.35-.40
Potash Caustic Electrolytic 88-92% broken, drums	lb.	.06¾-.08½
Potassium—Bichromate, casks (crystals)	lb.	.08
Carbonate, 96-98%	lb.	.06⅝
Cyanide, 165 lbs. cases, 94-96%	lb.	.50
Pumice, ground, bbls.	lb.	.02½
Quartz, powdered	ton	$30.00
Rosin, bbls.	lb.	.04½
Rouge—Nickel, 100 lb. lots	lb.	.25
Silver and Gold	lb.	.65
Sal Ammoniac (Ammonium Chloride) in bbls.	lb.	.05-.05½
Silver—Chloride, dry, 100 oz. lots	oz.	.23-.27½
Cyanide (fluctuating)	oz.	.30-.36
Nitrate, 100 ounce lots	oz.	.20-.23¾
Soda Ash, 58%, bbls.	lb.	.023
Sodium—Cyanide, 96 to 98%, 100 lbs.	lb.	.16½-.22
Beryllium fluoride ($2NaF.BeF_2$)	lb.	4.30-7.00
Hyposulphite, kegs, bbls.	lb.	.03½-.06½
Metasilicate, granular, bbls.	lb.	.03-.04
Nitrate, tech., bbls.	lb.	.03¼-.07
Phosphate, tech., bbls.	lb.	.03¾
Silicate (Water Glass), bbls.	lb.	.01½
Stannate, fluctuating	lb.	.21½
Sulphocyanide	lb.	.30-.45
Sulphur (Brimstone), bbls.	lb.	.02
Tin Chloride, fluctuating, 100 lb. kegs	lb.	.24-.24½
Tripoli, powdered	lb.	.03
Wax—Bees, white, ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
Whiting, Bolted	lb.	.02½-.06
Zinc—Carbonate, bbls.	lb.	.11
Chloride, drums, bbls.	lb.	.07½-.10
Cyanide (100 lb. kegs)	lb.	.38
Sulphate, bbls.	lb.	.03½

MONARCH FURNACES *MELT FOR LESS*

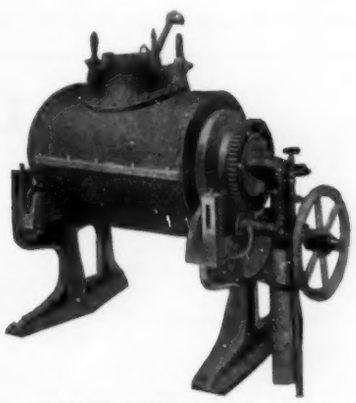
FACING FACTS

If your plant is not up to par, obsolescence has hit your equipment. Out-of-date equipment is costly to operate; it may also break down more often than is expected and repairs run into time and money.

Face the facts—Call us into conference. We will advise just what is necessary to bring your plant up-to-date.

STATIONARY CRUCIBLE FURNACE—
Low Air, Combustion Chamber

REVOLVING FURNACE—MOTOR DRIVEN
For Melting Brass, Copper, Aluminum, Gold, Silver and Other Metals and Alloys

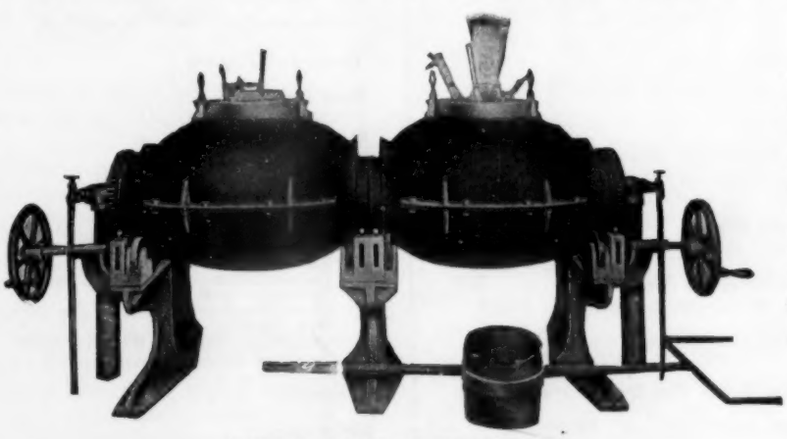


SIMPLEX FURNACE FIG. No. 92
Capacities from 500 to 24,000 lbs. per heat. Ask for detailed catalogue. Nos. 91 to 98—Air from 8 to 16 ounces from blower.

OUR FURNACES USE "OIL, GAS, COAL or COKE"—AND AIR

Many of the most prominent foundries in the world, foundries where equipment is chosen only after careful study of its merits, have repeatedly ordered Monarch Furnaces.

Write for Catalogue M.I.-4-33



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